THE REPERTORY OF ARTS, MANUFACTURES, AND AGRICULTURE.

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PRACTICAL AND INTERESTING PAPERS,

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THE PHILOSOPHICAL TRANSACTIONS AND SCIENTIFIC JOURNALS OF ALL NATIONS.

INTELLIGENCE

RELATING TO

THE USEFUL ARTS,

PROCEEDINGS OF LEARNED SOCIETIES,

AND

NOTICES OF ALL PATENTS GRANTED FOR INVENTIONS.

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THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLVII. SECOND SERIES. June 1815.

Specification of the Patent granted to Anthony Hill, *of Plymouth Iron-works, in the County of Glamorgan, Iron Master; for certain Improvements in the smelting and working of Iron.* Dated July 6, 1814.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said Anthony Hill do hereby declare that the nature of my said invention, and the manner of performing the same, are fully described and ascertained in manner following; that is to say: My said improvements do consist in the manipulations, processes and means hereinafter described and set forth, and by which the iron contained in the several sorts of slags or cinders produced in, or obtained from, the refinery furnace, the pudling furnace, and the balling or re-heating furnace, and which are produced in consequence of, or by or during the operations of, rolling, or by any treatment to which the crude or pig iron of the blast furnace may be, or is usually, subjected, in order to improve or alter the quality of the same, is by smelting and working made

into, or brought into, the state of bar iron, whether only one of the said several sorts of slags or cinders be used, or whether all the said sorts of the said slags or cinders, or any of the said several sorts of them, be mixed together and used; or whether all the said sorts of the said slags or cinders, or any one or more of the said sorts of them, be compounded with iron stones or iron ores, or with both of them, whether all the said several compounds be used together, or whether only one or more of the said several compounds be used, or whether only one of the several sorts of crude or pig iron obtained from the said slags or cinders, or the aforesaid mixtures of them be used; or whether all or any of the said several sorts of crude or pig iron be mixed and used together, or whether they, or any one or more of them, be mixed with one or more sort or sorts of any other crude or pig iron and used; or whether only one of the several sorts of crude or pig iron obtained from all or any or either of the said compounds of the said slags or cinders with iron stones or ores be used, or whether all or any of the said last-mentioned several sorts of crude or pig iron be mixed and used together; or whether they or any one or more of them be mixed with any one or more sort or sorts of any other crude or pig iron and used; or whether all or any or either of the aforesaid sorts of crude or pig iron be compounded and used with refined metal, obtained from the said slags or cinders, or from the said mixtures thereof, or from the said compounds of the said slags or cinders with iron stones and ores, or with the refined metal of any other iron, or whether only one of the several sorts of refined metal obtained from the said slags or cinders, or from the said mixtures thereof, or from the said last-mentioned compounds, be used; or whether all or any of the said last-mentioned

refined

refined metals be mixed and used together, or whether they or any one or more of them be mixed with any one or more sort or sorts of refined metal of any other iron and used; or whether only one of the several sorts of puddled iron obtained from the said slags or cinders, or from the said mixtures thereof, or from the said last-mentioned compounds, be used; or whether all or any of the said last-mentioned puddled irons be mixed and used together, or whether they or any one or more of them be mixed with any one or more sort or sorts of any other puddled iron and used.

And that my said improvements do further consist in the use and application of lime to iron, subsequently to the *operations* of the blast furnace, whereby that quality in iron, from which the iron is called *cold short*, howsoever and from whatever substance such iron be obtained, is sufficiently prevented or remedied, and by which such iron is rendered more tough when cold.

And I do further declare, that in the said smelting and working I do use a mixture of lime or lime-stone, and of the substance in which the iron-stones are generally found, and which is known in South Wales by the name of *mine rubbish*, whether raw or calcined, consisting, by weight, of about six parts of good lime-stone to five parts of raw mine rubbish. Which said mixture I do apply, together with the other materials operated upon in the blast furnace, for the purpose of producing a fusible cinder; and that the proportions of the said lime-stone and mine rubbish, composing the said mixture, may be varied, without materially impairing the beneficial effects thereof. And that in smelting and working by the usual working of the blast furnace, all or any or either of the said sorts of the said slags or cinders, or the aforesaid mixtures of them, or all or any or either of the said

 compounds

compounds thereof with iron-stones or ores, when such slags or cinders or compounds last-mentioned, are known by assay or otherwise, to be capable of affording crude or pig iron to the amount of fifty *per cent.* or thereabouts, by weight, I do, in order to make one charge, take and use eighteen cubic feet, by measure, or about four hundred and fifty pounds, by weight, of coke, and from three hundred pounds to four hundred and twenty pounds of the said slags or cinders, or the said last-mentioned mixtures or compounds, and from seventy pounds to ninety-five pounds of the said raw mine rubbish, and from one hundred and eighty pounds to two hundred and forty pounds of the said lime-stone, or from one hundred and ten pounds to one hundred and forty-five pounds of lime; which charge I do repeat according to the usual manner of filling and working the blast furnace. But that when the said slags or cinders, or the said last-mentioned mixtures or compounds, which are known, by assay or otherwise, to contain respectively either more or less than fifty *per cent.* by weight, of crude or pig iron, are required to be smelted and worked by the usual working of the blast furnace, it will be necessary, in order to produce the best effect, that the quantity and proportions thereof, and of the lime-stone and raw mine rubbish to be made use of in the charge as aforesaid, should be varied.

And that, as a general rule of practice to be adopted and followed, I declare that I do mix all or any or either of the said sorts of the said slags or cinders with raw mine rubbish if required; or I do mix all or any or either of the said last-mentioned compounds with raw mine rubbish, if required, until the crude or pig iron contained in either of such aggregate mixture shall amount to about forty *per cent*, or less than forty *per cent.* if so wished. And

And then, in order to constitute a charge, I do take from either or both of such aggregate mixtures from three hundred and fifty pounds to five hundred and fifty pounds, in the whole, and eighteen cubic feet by measure, or about four hundred and fifty pounds by weight, of coke. And I do flux the whole, by adding six parts, by weight, of limestone for every five of such parts of the raw mine rubbish as may have been used for the purpose last before mentioned. And I do add so much more lime or lime-stone as may be known, by assay or otherwise, to be required to produce a fusible cinder.

And further, that it will be adviseable to reduce the said slags or cinders, or the said mixtures of the said slags or cinders, or the said compounds of the said slags or cinders, with the said iron stones and ores, and the lime-stone and raw mine rubbish aforesaid, previous to their being put into the blast furnace, to about the size at which materials are commonly used in the blast furnace.

And further, I do draw off from the blast furnace the crude or pig iron afforded by the said slags or cinders, or by the said last-mentioned mixtures or compounds. And I do make the several sorts of crude or pig iron obtained from the said slags or cinders, or from the said last-mentioned mixtures or compounds, into bar iron, by puddling, re-heating, and rolling, compressing or hammering, or by refining, puddling, reheating, and rolling, compressing, or hammering, whether only one of the said several sorts of crude or pig iron be used, or whether all or any of the said several sorts of crude or pig iron be mixed and used together; or whether they or any one or more of them be mixed with any one or more sort or sorts of any other crude or pig iron; and used; or whether all or any or either of the aforesaid sorts of crude or pig iron be compounded and used with refined metal obtained from the said

said slags or cinders, or from the said mixtures thereof, or from the said compounds of the said slags or cinders with iron stones or ores, or with the refined metal of any other iron, and used; or whether only one of the several sorts of refined metal obtained from the said slags or cinders, or from the said mixtures thereof, or from the said last-mentioned compounds, be used; or whether all or any of the said last-mentioned refined metals be mixed and used together; or whether they or any one or more of them be mixed with any one or more sort or sorts of refined metal from any other iron, and used; or whether only one of the several sorts of puddled iron obtained from the said slags or cinders, or from the said mixtures thereof, or from the said last-mentioned compounds, be used; or whether all or any of the said last-mentioned puddled irons be mixed and used together; or whether they, or any one or more of them, be mixed with any one or more sort or sorts of any other puddled iron, and used.

And I do further declare, that I have discovered that the addition of lime or lime-stone, or other substances consisting chiefly of lime, and free or nearly free from any ingredient known to be hurtful to the quality of iron, will sufficiently prevent or remedy that quality in iron from which the iron is called cold-short, and will render such iron more tough when cold. And I do for this purpose, if the iron, howsoever and from whatever substance the same may have been obtained, be expected to prove cold-short, add a portion of lime or lime-stone, or of the other said substances of which the quantity must be regulated by the quality of the iron to be operated upon, and by the quality of the iron wished to be produced.

And further, that the said lime or lime-stone, or other aforesaid substances, may be added to the iron at any time

time subsequently to the reduction thereof in the blast furnace, and prior to the iron becoming clotted, or coming into nature, whether the same be added to the iron while it is in the refinery furnace or in the puddling furnace, or in both of them, or previous to the said iron being put into either of the said furnaces.

And further, that I do in preference add quick lime instead of lime-stone, or the said other substances, either of which, as to quantity, whensoever and howsoever so used, may be considerably varied to the iron in the refinery furnace and in the puddling furnace.

And I do further declare, that I do greatly prefer to mix or add in the refinery furnace about one-fourth to one-third, by weight, of the crude or pig iron, which has been obtained from the slags or cinders, with three-fourths or two-thirds of the crude or pig iron which has been obtained from the iron stones.

And I do further declare, that for the operation in the refinery furnace I do add the lime as it is obtained from the kiln in the proportion of from one sixtieth to one fortieth part, by weight, of the whole weight of the crude or pig iron intended to be worked in the furnace. And I apply about one-half of the said lime, together with the crude or pig iron, as it is thrown, upon the refinery fire, and the remainder from time to time during the course of the refinery operation, taking care not to suffer the slag or cinder which is produced to get too thick, nor to endanger the stopping up of the furnace.

And I do also declare, that in the puddling furnace I further add lime, in the proportion of from one hundredth to one eightieth part, by weight, of the whole weight of the iron in the furnace; which lime I previously slake and wet, to prevent it being carried off by the draft of the furnace. And I do apply the same in the course of that part

part of the operation which is known to workmen by the term drying the iron. And, moreover, I take care that the same shall be intimately mixed with, and minutely dispersed through, the iron by the usual operations of puddling.

In witness whereof, &c.

Specification of the Patent granted to GEORGE DUNNAGE, *Esquire, of Hammersmith, in the County of Middlesex; for a Method of rowing or propelling Boats and other Vessels.* Dated July 26, 1814.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said George Dunnage do hereby particularly describe and ascertain the nature of my said invention, and in what manner the same is to be performed, as follows; that is to say: Whereas, in the usual method of rowing the feet of the rower press against a part of the vessel as in barge-rowing, or in boat-rowing against a fixed stretcher, which commonly lies across the boat, and rests against the sides of it, by means of which stretcher the rower obtains a purchase, enabling him to apply a part of his strength to pulling the oar or oars; now, my improvement consists in making the stretcher moveable, and in connecting it with the oar or oars, or with an additional oar or float-board, to be worked either at the head or stern of barges, or other large vessels; in either case rendering the stretcher an active instead of a passive instrument. And I wish it to be clearly understood, that making the force of the feet and under parts of the rower assist the hands and upper parts of the rower,

Mr. Dunnage's Patent.

Fig. 1. No. 2.

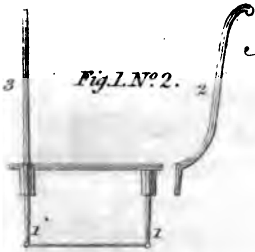


Fig. 1. No. 1.

Fig. 2.

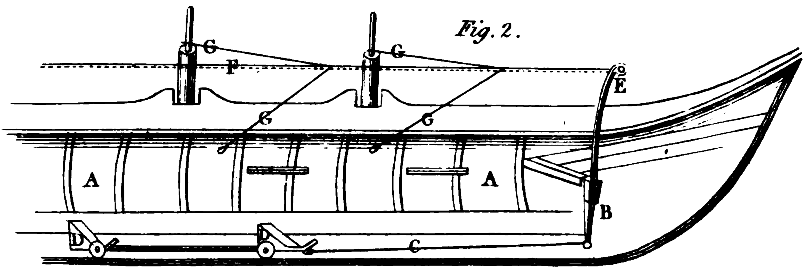
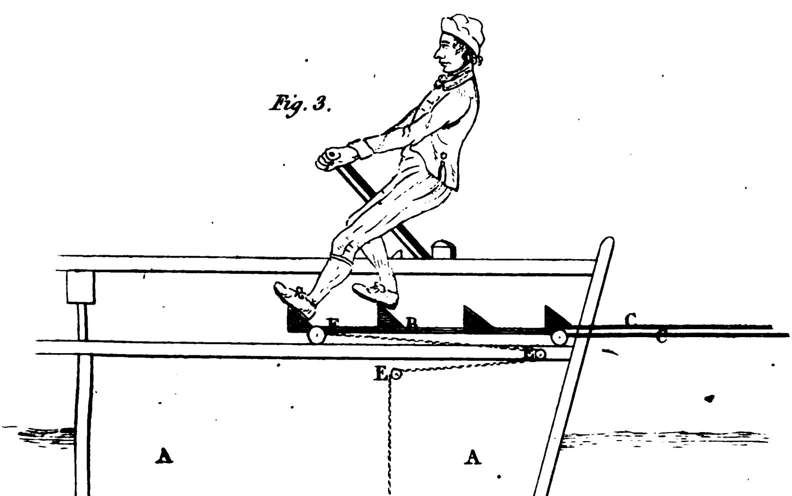


Fig. 3.



rower, by pulling the oar or oars in a contrary direction to the force exerted by the feet, or otherwise by enabling the feet to work an additional oar or float board, thus obtaining a purchase in the water independent of the vessel, is what I claim as my invention or improvement. It is my desire likewise, that it may be clearly understood, that the apparatus used to produce these effects may and must be varied beyond all possibility of description, by drawing or otherwise, in the course of adapting it to the size and kind of vessel to be propelled, or to the number of rowers to be employed in the same vehicle: but notwithstanding such variation of means, while they enable the feet and hands of the rower to pull together in the same direction, or enable the rower to work an additional oar or float-board by his feet, they are to be considered as different ways of obtaining the same end.

The methods I use to carry the above improvement into practice are, by connecting a moveable stretcher, or moveable stretchers, with the oars, as in Figs. 1 and 2 (Plate I.) in the drawing hereunto annexed, and by working an additional oar or float board with the feet, by means also of a moveable stretcher, as in Fig. 3, in the said drawing, as follows:

First, in a boat where one man only is employed, as in Fig. 1, No. 1, in the drawing hereto annexed, where A A represents a longitudinal section of a part of a boat: suspend from the thwart or seat of the rower B, on hinges or centres, a light iron frame C C, sixteen or eighteen inches wide and eight or nine inches deep. At the upper corners of this frame, D D, let there be sockets made, in order to receive two light iron stanchions E E, made of such length, that when shipped into the sockets they may stand from sixteen to eighteen inches, or more if necessary, above the thwart. The upper ends of these

stanchions should have an eye, through which a rope or line may be fastened; and the other end of such rope or line F F should be formed into a small loop, just sufficient to receive the handle of the oar or skull. From the lower corners of the iron frame already described, two thin iron rods, G G, must be attached, running in a directions towards the stern of the boat. The other ends of these rods must be screwed, or otherwise fastened, to a moveable stretcher H; which stretcher must be made to run on two small wheels or rollers I, Fig. 1.

No. 2 consists of a front view of the iron frame, 1, 1, to be suspended from the thwart, a stanchion out of the socket 2, a stanchion shipped in the frame 3. The stanchions being placed in the sockets, the loops being put over the ends of the oars, and the rower having placed himself on the seat, with his feet resting on the moveable stretcher, it is obvious, that when he pulls the oars with his hands he must push the stretcher with equal force with his feet; and it is equally plain, that this force, so applied to the stretcher, must immediately pull the oars, and thereby assist or ease the labour of the rower.

Secondly. Fig. 2, A A, in the drawings hereto annexed, represents a longitudinal section of a part of a boat in which two or more persons row together. Instead of the iron frame before described, let an iron rod or bar B, having a socket at the top to receive a stanchion, as in Fig. 1, be suspended by a hinge, or on centres, from any convenient part of the boat a-head of the head-most rower: the lower end of this rod or bar must be fastened either by an iron rod, or by a rope, C, to the head-most stretcher. The stretchers D D must run on rollers, as before described; the number of them corresponding with the number of rowers as in the usual method

method of rowing, and they must all be connected either by iron rods or ropes passing from one to the other. To the upper end of the stanchion E a rope F must be fastened, which from thence will pass along the middle of the boat towards the stern. At a convenient distance a-head of each row-lock, a line G G G G, having a loop at the end of it, must branch off from the last-mentioned rope, and there being as many of the last-mentioned lines as oars, each loop must be put over the handle of the oar it is designed to pull in the act of rowing.

Thirdly. The use of a moveable stretcher will enable the rower to work an additional oar or float board with his feet, as at Fig. 3, in the drawing hereto annexed, where *A A* represents a longitudinal section of part of a barge, and he may thus obtain a purchase in the water, instead of obtaining it in the usual way on the vessel itself. To effect this, to a moveable stretcher B, made as described in said figure, two iron rods, or bars of hard wood, C C, must be attached. The other ends of these rods or bars must pass through the barge or other vessel; and with these an additional oar or float board must be connected and worked. A weight D must be suspended by a rope, which running over the pullies E E, and having the other end fastened to the staple F, serves to run the stretcher back as soon as the rower has stepped off it, preparatory to renewing his stroke.

In witness whereof, &c.

Remarks by the Patentee.

Prior to obtaining a Patent for an improved method of rowing or propelling boats, &c. I endeavoured by repeated experiments, made by means of weights and a machine constructed for that purpose, to ascertain the

exact amount of advantage which such improvement would produce, particularly as it applies to the most simple application of it, as delineated at Fig. 1, in the drawing annexed to my specification.

The conclusion arising from these experiments was, that the use of a moveable stretcher would render any portion of strength employed by the rower more efficient than when exerted in the usual way, to the amount of 33 *per cent.* This appeared to me a very great improvement; and in practice I expected to see the boat move through the water with an increase of velocity, corresponding with this result, making a proper allowance for additional friction.

Upon trying my improvement on the water, I found the event did not tally with my expectations. After repeated trials, by rowing a given distance, first in the usual way, and then with the improvement, and carefully noting, by means of a stop-watch, the difference of time employed under each operation, it was found that the increased velocity amounted to about 11 *per cent.* only in favour of a moveable stretcher; but this, with an allowance for increase of friction, was but a moiety of the expected advantage.

In trying these experiments, the rower started in the common way, and exerted his strength as far as he thought was consistent with a reasonable continuance of such labour. He designed to make use of the same degree of effort when trying the improvement; this equality of labour he could not employ, for he found that when the feet assist the hands, by means of a moveable stretcher, his labour, while obtaining the above-mentioned increase of velocity, was very sensibly diminished, and, according to his belief, to the amount of 16 *per cent.* at least. Of course this decrease of labour was matter of opinion,

and

and could not be measured like increased velocity; but a very competent judge, after repeated trials, was fully satisfied that a great diminution of labour was unquestionable, and that the amount could not be less than as above stated.

From these data I conceive myself justified in concluding that the result of my experiments, made by means of weights, &c. was correct; that the improved method possesses an actual advantage over that in common use to the amount of 33 and a fraction *per cent.*; and, finally, that this advantage is pretty equally divided between increased speed and diminished labour. In other words, a man will propel a boat something more than five miles, if assisted by a moveable stretcher, in the same time that in the usual way he would require to row four miles and a half, and that he would perform this with one-sixth part less labour.

I am convinced, from various experiments, that any considerable portion of purchase obtained by the feet of the rower, independent of the vessel, would add greatly to the propelling force; but as, owing to indisposition, I have not yet been able to ascertain, by actual practice, the advantage which I flatter myself will result from the application of my improvement to larger vessels, as delineated at Fig. 3 of the above-mentioned drawing, I shall reserve any farther remarks on the subject for a future opportunity.

N. B. In order to shew the connection between the lines and oars in Fig. 2, (Plate I.) the latter are drawn in a vertical direction. When the oars are in a rowing position the lines and rope pass along the middle of the boat, and do not incommode the rowers.

Specification

Specification of the Patent granted to AMBROSE FIRMIN DIDOT, *of Holborn, in the County of Middlesex, Gentleman; for a Method of making Types or Characters to be used in the Art of Printing.*

Dated October 3, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Ambroise Firmin Didot do hereby declare that the nature of my said invention, and the manner of performing the same, are particularly described and ascertained in manner following; that is to say: In all the kinds or descriptions of letters or characters formed, made, or used, in the writing called Roman text, or running hand, or any other hand, consisting more or less in hair strokes or fine lines from letter to letter, I do cast my types in a mould as usual, but I do prolong each of the connecting extremities of the letter severally and respectively into the body of the next succeeding letter, whatever may be the angle or inclination of the said letters or extremities with or unto the line to be formed of or by such letters, so that the place or point of junction shall thereby be rendered complete, and without any interstice upon the printed copy to be taken therefrom. And, further, with regard to such letters as have an inclination or slope in the face thereof, (as is the case with most kinds of the writing in common use,) I do, by suitable alteration in my moulds, cast my types, and the boards and shanks or tails thereof, with the same, or nearly the same, inclination or slope of surface as aforesaid with regard to the said face; so that instead of the types being set up or composed as usually is done with common types, by the contact of faces at right angles to the line or direction of the letters, my said types, last-mentioned,

mentioned, are set up or composed by the contacts of the inclined or sloped surfaces thereof. And whereas it will follow, by necessary consequence of the decomposition of oblique force, that the action of the usual means of securing the line of types in their places would cause the said inclined or slope surfaces to slide upon each other more or less, and would, if not remedied, be productive of bad fitting and other noxious effects; now I do further declare, that by a suitable configuration of the said moulds, I do cast each of my said types with a protuberance or projecting part from one of the said inclined or slope faces, and a cavity or indentation in the other opposite inclined or slope face. And I *do give such* positions and forms, outlines or figures, to *the said* protuberances or projecting parts, and also to the said cavities or indentations as that the same may in any row or line of types duly composed, either fit into each other in succession, or become so applied together as firmly, steadily, and effectually, to prevent any sliding of the said inclined or slope surfaces upon each other; or otherwise I do, by angular or curved deviations, form * in or as to the straight direction of the said surfaces render it impossible that any sliding should take place between the same.

And, lastly, whereas in many of the joinings of letters, whether inclined or upright, by hair strokes or fine lines, the hair stroke is required to be made with such varieties of directions (as, for example, when the letter *a* is followed by the letter *n* in *an)* as will not allow the same to be carried across the place of junction of the types without greatly impairing the neatness thereof; I do in this and the like cases, or as convenience may require, not only cast separate types for separate letters, but also for

* Compared with the record.

the

the parts of letters needful or expedient to be set or composed together; and by that means I am enabled to execute the most difficult or inconvenient joinings upon the face of a type, or in the middle of the said face, instead of being obliged to make all my joinings at the place where the said types are in contact, and can insert or use any connecting ligatures or joining pieces or strokes which may be fitting, convenient, or suitable to the hand or description, or kind of writing or printing, or in any other respect howsoever.

In witness whereof, &c.

On Agricultural Chemistry.

Extracted from Sir HUMPHRY DAVY's Lectures.

Of Manures of vegetable and animal Origin. Of the Manner in which they become the Nourishment of the Plant. Of Fermentation and Putrefaction. Of the different Species of Manures of vegetable Origin; of the different Species of animal Origin. Of mixed Manures. General Principles with respect to the Use and Application of such Manures.

SIR Humphry states, that certain vegetable and animal substances introduced into the soil accelerate vegetation and increase the produce of crops, is a fact known since the earliest period of agriculture; but the manner in which manures act, the best modes of applying them, their relative value and durability, are still subjects of discussion. In this Lecture (he says) I shall endeavour to lay down some settled principles on these objects; they are capable of being materially elucidated by the recent discoveries in chemistry; and I need not dwell on their great importance to farmers.

The

The pores in the fibres of the roots of plants are so small, that it is with difficulty they can be discovered by the microscope; it is not therefore probable, that solid substances can pass into them from the soil. I tried an experiment on this subject; some impalpable powdered charcoal procured by washing gunpowder, and dissipating the sulphur by heat, was placed in a phial containing pure water, in which a plant of peppermint was growing: the roots of the plant were pretty generally in contact with the charcoal. The experiment was made in the beginning of May 1805, the growth of the plant was very vigorous during a fortnight, when it was taken out of the phial: the roots were cut through in different parts; but no carbonaceous matter could be discovered in them, nor were the smallest fibrils blackened by charcoal, though this must have been the case had the charcoal been absorbed in a solid form.

No substance is more necessary to plants than carbonaceous matter; and if this cannot be introduced into the organs of plants except in a state of solution, there is every reason to suppose that other substances less essential will be in the same case.

I found, by some experiments made in 1804, that plants introduced into strong fresh solutions of sugar, mucilage, tanning principle, jelly, and other substances died; but that plants lived in the same solutions after they had fermented. At that time I supposed that fermentation was necessary to prepare the food of plants; but I have since found that the deleterious effect of the recent vegetable solutions was owing to their being too concentrated; in consequence of which the vegetable organs were probably clogged with solid matter, and the transpiration by the leaves prevented. In the beginning of June in the next year, I used solutions of the

 same

same substances, but so much diluted, that there was only about one two-hundredth part of solid vegetable or animal matter in the solutions. Plants of mint grew luxuriantly in all these solutions; but least so in that of the astringent matter. I watered some spots of grass in a garden with the different solutions separately, and a spot with common water: the grass watered with solutions of jelly, sugar, and mucilage, grew most vigorously; and that watered with the solution of the tanning principle grew better than that watered with common water.

I endeavoured to ascertain whether soluble vegetable substances passed in an unchanged state into the roots of plants, by comparing the products of the analysis of the roots of some plants of mint which had grown, some in common water, some in a solution of sugar. One hundred and twenty grains of the roots of the mint which grew in the solution of sugar, afforded five grains of pale green extract, which had a sweetish taste, but which slightly coagulated by the action of alcohol. One hundred and twenty grains of the roots of the mint which had grown in common water yielded three grains and a half of extract, which was of a deep olive colour; its taste was sweetish, but more astringent than that of the other extract, and it coagulated more copiously with alcohol.

These results, though not quite decisive, favour the opinion, that soluble matters pass unaltered into the roots of plants; and the idea is confirmed by the circumstance that the radical fibres of plants made to grow in infusions of madder are tinged red, and it may be considered as almost proved by the fact, that substances which are even poisonous to vegetables are absorbed by them. I introduced the roots of a primrose into a weak solution

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of oxyd of iron in vinegar, and suffered it to remain in it till the leaves became yellow; the roots were then carefully washed in distilled water, bruised, and boiled in a small quantity of the same fluid: the decoction of them passed through a filtre was examined by the test of infusion of nut-galls; the decoction gained a strong tint of purple, which proves that solution of iron had been taken up by the vessels or pores in the roots.

Vegetable and animal substances deposited in the soil, as is shewn by universal experience, are *consumed* during the process of vegetation; and they can only nourish the plant by affording solid matters capable of being dissolved by water, or gaseous substances capable of being absorbed by the fluids in the leaves of vegetables; but such parts of them as are rendered gaseous, and that pass into the atmosphere, must produce a comparatively small effect, for gasses soon become diffused through the mass of the surrounding air. The great object in the application of manure should be to make it afford as much soluble matter as possible to the roots of the plant; and that in a slow and gradual manner, so that it may be entirely consumed in forming its sap and organized parts.

Mucilaginous, gelatinous, saccharine, oily, and extractive fluids, and solution of carbonic acid in water, are substances that in their unchanged states contain almost all the principles necessary for the life of plants; but there are few cases in which they can be applied as manures in their pure forms; and vegetable manures, in general, contain a great excess of fibrous and insoluble matter, which must undergo chemical changes before they can become the food of plants.

It will be proper to take a scientific view of the nature of these changes; of the causes which occasion

them, and which accelerate or retard them; and of the products they afford.

If any fresh vegetable matter which contains sugar, mucilage, starch, or other of the vegetable compounds soluble in water, be moistened and exposed to air, at a temperature from 55° to 80°, oxygen will soon be absorbed, and carbonic acid formed; heat will be produced, and elastic fluids, principally carbonic acid, gaseous oxyd of carbon, and hydro-carbonate will be evolved; a dark coloured liquid, of a slightly sour or bitter taste, will likewise be formed; and if the process be suffered to continue for a time sufficiently long, nothing solid will remain, except earthy and saline matter, coloured black by charcoal.

The dark coloured fluid formed in the fermentation always contains acetic acid; and when albumen or gluten exists in the vegetable substance, it likewise contains volatile alkali.

In proportion as there is more gluten, albumen, or matters soluble in water in the vegetable substances exposed to fermentation, so in proportion, all other circumstances being equal, will the process be more rapid. Pure woody fibre alone undergoes a change very slowly; but its texture is broken down, and it is easily resolved into new elements, when mixed with substances more liable to change, containing more oxygen and hydrogen. Volatile and fixed oils, resins and wax, are more susceptible of change than woody fibre, when exposed to air and water; but much less liable than the other vegetable compounds; and even the most inflammable substances, by the absorption of oxygen, become gradually soluble in water.

Animal matters in general are more liable to decompose than vegetable substances; oxygen is absorbed, and carbonic

carbonic acid and ammonia formed in the process of their putrefaction. They produce fœtid compound elastic fluids, and likewise azote; they afford dark coloured acid and oily fluids, and leave a residuum of salts and earths mixed with carbonaceous matter.

The principal substances which constitute the different parts of animals, or which are found in their blood, their secretions, or their excrements, are gelatine, fibrine, mucus, fatty or oily matter, albumen, urea, uric acid, and different acid, saline, and earthy matters.

Of these *gelatine* is the substance which when combined with water forms jelly. It is very liable to putrefaction. According to MM. Gay-Lussac and Thenard, it is composed of

47.88 of carbon,
27.207 of oxygen,
7.914 of hydrogen,
16.998.

These proportions cannot be considered as definite, for they do not bear to each other the ratios of any simple multiples of the number representing the elements; the case seems to be the same with other animal compounds; and even in vegetable substances, in general, as appears from the statements given in the Third Lecture, the proportions are far from having the same simple relations as in the binary compounds capable of being made artificially, such as acids, alkalies, oxyds, and in salts.

Fibrine constitutes the basis of the muscular fibre of animals, and a similar substance may be obtained from recent fluid blood; by stirring it with a stick the fibrine will adhere to the stick. It is not soluble in water; but by the action of acids, as Mr. Hatchet has shewn, it becomes soluble, and analogous to gelatine. It is less disposed to putrefy than gelatine. According to MM. Gay-Lussac

Lussac and Thenard, 100 parts of fibrine contain of

Carbon 53.360
Oxygen 19.685
Hydrogen.... 7.021
Azote........19.934

Mucus is very analogous to vegetable *gum* in its characters; and as Dr. Bostock has stated, it may be obtained by evaporating saliva. No experiments have been made upon its analysis; but it is probably similar to gum in composition. It is capable of undergoing putrefaction, but less rapidly than fibrine.

Animal fat and *oils* have not been accurately analysed; but there is great reason to suppose that their composition is analogous to that of similar substances from the vegetable kingdom.

Albumen has been already referred to, and its analysis stated in the Third Lecture.

Urea may be obtained by the evaporation of human urine till it is of the consistence of a syrup; and the action of alcohol on the crystalline substance which forms when the evaporated matter cools. In this way a solution of urea in alcohol is procured, and the alcohol may be separated from the urea by heat. Urea is very soluble in water, and is precipitated from water by diluted nitric acid in the form of bright pearl coloured crystals; this property distinguishes it from all other animal substances.

According to Fourcroy and Vauquelin, 100 parts of urea when distilled yield

92.027 parts of carbonate of ammonia,
4.608 carburetted hydrogen gas,
3,225 of charcoal.

Urea, particularly when mixed with albumen or gelatine, readily undergoes putrefaction.

Uric

Uric acid, as has been shewn by Dr. Egan, may be obtained from human urine by pouring an acid into it; and it often falls down from urine in the form of brick coloured crystals. It consists of carbon, hydrogen, oxygen, and azote: but their proportions have not yet been determined. Uric acid is one of the animal substances least liable to undergo the process of putrefaction.

According to the different proportions of these principles in animal compounds so are the changes they undergo different. When there is much saline or earthy matter mixed or combined with them, the progress of their decomposition is less rapid than when they are principally composed of fibrine, albumen, gelatine, or urea.

The ammonia given off from animal compounds in putrefaction may be conceived to be formed at the time of their decomposition by the combination of hydrogen and azote; except this matter, the other products of putrefaction are analogous to those afforded by the fermentation of vegetable substances; and the soluble substances formed abound in the elements, which are the constituent parts of vegetables, in carbon, hydrogen, and oxygen.

Whenever manures consist principally of matter soluble in water, it is evident that their fermentation or putrefaction should be prevented as much as possible; and the only cases in which these processes can be useful are when the manure consists principally of vegetable or animal fibre. The circumstances necessary for the putrefaction of animal substances are similar to those required for the fermentation of vegetable substances; a temperature above the freezing point, the presence of water, and the presence of oxygen, at least in the first stage of the process.

To prevent manures from decomposing, they should be preserved dry, defended from the contact of air, and kept as cool as possible.

Salt and alcohol appear to owe their powers of preserving animal and vegetable substances to their attraction for water, by which they prevent its decomposing action, and likewise to their excluding air. The use of ice in preserving animal substances is owing to its keeping their temperature low. The efficacy of M. Appert's method of preserving animal and vegetable substances, an account of which has been lately published, entirely depends upon the exclusion of air. This method is by filling a vessel of tin plate or glass with the meat or vegetables; soldering or cementing the top so as to render the vessel air-tight; and then keeping it half immersed in a vessel of boiling water for a sufficient time to render the meat or vegetables proper for food. In this last process it is probable that the small quantity of oxygen remaining in the vessel is absorbed; for on opening a tinned iron canister which had been filled with raw beef, and exposed to hot water the day before, I found that the minute quantity of elastic fluid which could be procured from it was a mixture of carbonic acid gas and azote.

Where meat or vegetable food is to be preserved on a large scale, for the use of the navy or army for instance, I am inclined to believe, that by forcibly throwing a quantity of carbonic acid, hydrogen, or azote, into the vessel, by means of a compressing pump, similar to that used for making artificial Seltzer water, any change in the substance would be more effectually prevented. No elastic fluid in this case would have room to form by the decomposition of the meat; and the tightness and strength of the vessel would be proved by the process.

No

No putrefaction or fermentation can go on without the generation of elastic fluid; and pressure would probably act with as much efficacy as cold in the preservation of animal or vegetable food.

As different manures contain different proportions of the elements necessary to vegetation, so they require a different treatment to enable them to produce their full effects in agriculture. I shall therefore describe in detail the properties and nature of the manures in common use, and give some general views respecting the best modes of preserving and applying them.

All *green succulent plants* contain saccharine or mucilaginous matter, with woody fibre, and readily ferment. They cannot, therefore, if intended for manure, be used *too soon after* their death.

When *green crops* are to be employed for enriching a soil, they should be ploughed in, if it be possible, when in flower, or at the time the flower is beginning to appear, for it is at this period that they contain the largest quantity of easily soluble matter, and that their leaves are most active in forming nutritive matter. Green crops, pond weeds, the paring of hedges or ditches, or any kind of fresh vegetable matter, requires no preparation to fit them for manure. The decomposition slowly proceeds beneath the soil; the soluble matters are gradually dissolved, and the slightest fermentation that goes on checked by the want of a free communication of air, tends to render the woody fibre soluble without occasioning the rapid dissipation of elastic matter.

When old pastures are broken up and made arable, not only has the soil been enriched by the death and slow decay of the plants which have left soluble matters in the soil; but the leaves and roots of the grasses living at the time and occupying so large a part of the surface,

 afford

afford saccharine, mucilaginous, and extractive matters, which become immediately the food of the crop, and the gradual decomposition affords a supply for successive years.

Rape cake, which is used with great success as a manure, contains a large quantity of mucilage, some albuminous matter, and a small quantity of oil. This manure should be used recent, and kept as dry as possible before it is applied. It forms an excellent dressing for turnip crops; and is most œconomically applied by being thrown into the soil at the same time with the seed. Whoever wishes to see this practice in its highest degree of perfection, should attend Mr. Coke's annual sheep-shearing at Holkham.

Malt dust consists chiefly of the infant radicle separated from the grain. I have never made any experiment upon this manure; but there is great reason to suppose it must contain saccharine matter, and this will account for its powerful effects. Like rape cake, it should be used as dry as possible, and its fermentation prevented.

Linseed cake is too valuable as a food for cattle to be much employed as a manure; the analysis of linseed was referred to in the Third Lecture. *The water* in which *flax* and *hemp* are steeped for the purpose of obtaining the pure vegetable fibre, has considerable fertilizing powers. It appears to contain a substance analogous to albumen, and likewise much vegetable extractive matter. It putrefies very readily. A certain degree of fermentation is absolutely necessary to obtain the flax and hemp in a proper state; the water to which they have been exposed should therefore be used as a manure as soon as the vegetable fibre is removed from it.

Sea weeds, consisting of different species of fuci, algæ, and

and confervæ, are much used as a manure on the sea coasts of Britain and Ireland. By digesting the common fucus, which is the sea weed usually most abundant on the coast, in boiling water, I obtained from it one-eighth of a gelatinous substance which had characters similar to mucilage. A quantity distilled gave nearly four-fifths of its weight of water, but no ammonia; the water had an empyreumatic and slightly sour taste; the ashes contained sea salt, carbonate of soda, and carbonaceous matter. The gaseous matter afforded was small in quantity, principally carbonic acid and gaseous oxyd of carbon, with a little hydro-carbonate. This manure is transient in its effects, and does not last for more than a single crop, which is easily accounted for from the large quantity of water, or the elements of water, it contains. It decays without producing heat when exposed to the atmosphere, and seems, as it were, to melt down and dissolve away. I have seen a large heap entirely destroyed in less than two years, nothing remaining but a little black fibrous matter.

I suffered some of the firmest part of a fucus to remain in a close jar, containing atmospheric air, for a fortnight: in this time it had become very much shrivelled; the sides of the jar were lined with dew. The air examined was found to have lost oxygen, and contained carbonic acid gas.

Sea weed is sometimes suffered to ferment before it is used; but this process seems wholly unnecessary, for there is no fibrous matter rendered soluble in the process, and a part of the manure is lost.

The best farmers in the west of England use it as fresh as it can be procured; and the practical results of this mode of applying it are exactly conformable to the theory of its operation. The carbonic acid formed by its

incipient fermentation must be partly dissolved by the water set free in the same process; and thus become capable of absorption by the roots of plants.

The effects of the sea weed, as manure, must principally depend upon this carbonic acid, and upon the soluble mucilage the weed contains; and I found that some fucus which had fermented so as to have lost about half its weight, afforded less than one-twelfth of mucilaginous matter; from which it may be fairly concluded that some of this substance is destroyed in fermentation.

Dry straw of wheat, oats, barley, beans, and peas, and spoiled hay, or any other similar kind of dry vegetable matter, is, in all cases, useful manure. In general, such substances are made to ferment before they are employed, though it may be doubted whether the practice should be indiscriminately adopted.

From 400 grains of dry barley straw I obtained eight grains of matter soluble in water, which had a brown colour, and tasted like mucilage. From 400 grains of wheaten straw I obtained five grains of a similar substance.

There can be no doubt that the straw of different crops immediately ploughed into the ground affords nourishment to plants; but there is an objection to this method of using straw from the difficulty of burying long straw, and from its rendering the husbandry foul.

When straw is made to ferment, it becomes a more manageable manure; but there is likewise, on the whole, a great loss of nutritive matter. More manure is perhaps supplied for a single crop; but the land is less improved than it would be, supposing the whole of the vegetable matter could be finely divided and mixed with the soil.

It is usual to carry straw that can be employed for no other purpose to the dunghill, to ferment, and decompose;

pose; but it is worth experiment, whether it may not be more œconomically applied when chopped small by a proper machine, and kept dry till it is ploughed in for the use of a crop. In this case, though it would decompose much more slowly, and produce less effect at first, yet its influence would be much more lasting.

Mere woody fibre seems to be the only vegetable matter that requires fermentation to render it nutritive to plants. Tanners *spent bark* is a substance of this kind. Mr. Young, in his excellent Essay on Manures, which gained him the Bedfordian medal of the Bath Agricultural Society, states, "that spent bark seemed rather to injure than assist vegetation;" which he attributes to the astringent matter that it contains. But, in fact, it is freed *from all* soluble substances, by the operation of water in the tan-pit; and if injurious to vegetation, the effect is probably owing to its agency upon water, or to its mechanical effects. It is a substance very absorbent and retentive of moisture, and yet not penetrable by the roots of plants.

Inert peaty matter is a substance of the same kind. It remains for years exposed to water and air without undergoing change, and in this state yields little or no nourishment to plants.

Woody fibre will not ferment unless some substances are mixed with it, which act the same part as the mucilage, sugar, and extractive or albuminous matters, with which it is usually associated in herbs and succulent vegetables. Lord Meadowbank has judiciously recommended a mixture of common farm-yard dung for the purpose of bringing peats into fermentation; any putrescible or fermentable substance will answer the end; and the more a substance heats, and the more readily it ferments, the better will it be fitted for the purpose.

Lord

Lord Meadowbank states, that one part of dung is sufficient to bring three or four parts of peat into a state in which it is fitted to be applied to land; but of course the quantity must vary according to the nature of the dung and of the peat. In cases in which some living vegetables are mixed with the peat, the fermentation will be more readily effected.

Tanners spent bark, shavings of wood and saw-dust, will probably require as much dung to bring them into fermentation as the worst kind of peat.

Woody fibre may be likewise prepared so as to become a manure, by the action of lime. This subject I shall discuss in the next Lecture, as it follows naturally another series of facts, relating to the effects of lime in the soil.

It is evident from the analysis of woody fibre by MM. Gay Lussac and Thenard, (which shews that it consists principally of the elements of water and carbon, the carbon being in larger quantities than in the other vegetable compounds) that any process which tends to abstract carbonaceous matter from it, must bring it nearer in composition to the soluble principles; and this is done in fermentation by the absorption of oxygen and production of carbonic acid; and a similar effect, it will be shewn, is produced by lime.

Wood-ashes imperfectly formed, that is, wood-ashes containing much charcoal, are said to have been used with success as a manure. A part of their effects may be owing to the slow and gradual consumption of the charcoal, which seems capable, under other circumstances than those of actual combustion, of absorbing oxygen so as to become carbonic acid.

In April, 1803, I enclosed some well-burnt charcoal in a tube half filled with pure water, and half with common air; the tube was hermetically sealed. I opened the tube

tube under pure water, in the spring of 1804, at a time when the atmospheric temperature and pressure were nearly the same as at the commencement of the experiment. Some water rushed in; and on expelling a little air by heat from the tube, and analyzing it, it was found to contain only seven *per cent.* of oxygen. The water in the tube, when mixed with lime-water, produced a copious precipitate; so that carbonic acid had evidently been formed and dissolved by the water.

Manures from animal substances, in general, require no *chemical* preparation to fit them for the soil. The great object of the farmer is to blend them with the earthy constituents in a proper state of division, and to prevent their too rapid decomposition.

The entire parts of the muscles of land animals are not commonly used as manure, though there are many cases in which such an application might be easily made. Horses, dogs, sheep, deer, and other quadrupeds that have died accidentally, or of disease, after their skins are separated, are often suffered to remain exposed to the air, or immersed in water, till they are destroyed by birds or beasts of prey, or entirely decomposed; and in this case, most of their organized matter is lost for the land in which they lie, and a considerable portion of it employed in giving off noxious gases to the atmosphere.

By covering dead animals with five or six times their bulk of soil, mixed with one part of lime, and suffering them to remain for a few months, their decomposition would impregnate the soil with soluble matters, so as to render it an excellent manure; and by mixing a little fresh quick lime with it at the time of its removal, the disagreeable effluvia would be in a great measure destroyed; and it might be applied in the same way as any other manure to crops.

Fish

Fish forms a powerful manure, in whatever state it is applied; but it cannot be ploughed in too fresh, though the quantity should be limited. Mr. Young records an experiment, in which herrings spread over a field, and ploughed in for wheat, produced so rank a crop, that it was entirely laid before harvest.

The refuse pilchards in Cornwall are used throughout the county as a manure, with excellent effects. They are usually mixed with sand or soil, and sometimes with sea weed, to prevent them from raising too luxuriant a crop. The effects are perceived for several years.

In the fens of Lincolnshire, Cambridgeshire, and Norfolk, the little fishes called sticklebacks, are caught in the shallow waters in such quantities, that they form a great article of manure in the land bordering on the fens.

It is easy to explain the operation of fish as a manure. The skin is principally gelatine; which from its slight state of cohesion, is readily soluble in water: fat or oil is always found in fishes, either under the skin or in some of the viscera; and their fibrous matter contains all the essential elements of vegetable substances.

Amongst oily substances, *blubber* has been employed as a manure. It is most useful when mixed with clay, sand, or any common soil, so as to expose a large surface to the air, the oxygen of which produces soluble matter from it. Lord Somerville used blubber with great success at his farm in Surrey. It was made into a heap with soil, and retained its powers of fertilizing for several successive years.

The carbon and hydrogen abounding in oily substances, fully account for their effects; and their durability is easily explained from the gradual manner in which they change by the action of air and water.

TO BE CONCLUDED IN OUR NEXT.

Additional

Additional Information on Soiling, or the Feeding of Cattle in the House, and other Improvements connected with Agriculture. By J. C. Curwen, *Esq. of Workington Hall in Cumberland.*

The Thanks of the Society were voted to Mr. Curwen *for this Communication.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

THE Society instituted for the Encouragement of Arts, Manufactures, and Commerce, having approved and sanctioned the system of soiling, I trust it may be satisfactory to them to receive a farther proof of its utility than has hitherto been brought before the public. I am not acquainted with any experiments made to ascertain the practicability of rearing stock in the house. If such exists, they are without my knowledge.

I have to state to the Society, that my heifer was calved the 15th February, 1812, and was reared in the house.

For the first five weeks it had a gallon of new milk daily. From that time to the middle of May two gallons, and from thence to the 16th June one gallon, and hay tea. It had grass and clover to the middle of October, and from thence to Midsummer last was fed with turnips, mangel wurzel, and wheat-straw: during the remainder of the Summer and Autumn with refuse grass, and from October till the time it was killed in March last, it was fed with turnips and wheat-straw. As my purpose was to breed from it, every means was taken to check its progress to fatten; finding this could not be done, it was thought adviseable to slaughter it on 15th March last. The following is the statement of its weight.

When taken from food it weighed 72 stones, of 14 lb. each. After fasting 48 hours, it weighed 68 stone.

Blood weighed	2 stone	7 pounds.
Bag	9	3
Hide	4	0
Feet	1	2
Puddings	3	12
Head and heart	2	8
Tallow	6	6
Carcass	38	4
Total........	68	0

Sale.

	£.	s.	d.
Carcass, at 9*s. per* stone....	17	4	6
Tallow	3	4	0
Hide	1	7	0
Sundries	0	5	0
	£.22	0	6

Expense.

	£.	s.	d.
Value when dropped	2	2	0
Feeding	12	18	6
Gain.....................	7	0	0
	£.22	0	6

The manure should more than compensate for the labour. If the object had been to feed it, a greater weight might have been obtained at little or no more expense. The colour of the meat was beautiful, and the grain and flavour could not be surpassed. As this is the first instance

stance of beef being produced in so short a time, it has occasioned a good deal of speculation.

The heifer was of the short horned breed, got by a bull of C. Mason's, of Chilton.

The success of this experiment has determined me to try it on a pretty extensive scale; if cattle can be stall-fed from their birth, and slaughtered at two years old, the farmer and the public will both be benefited.

I am very sanguine in the success of my experiment in rearing cattle. I have thirteen calves, and expect two more that shall be reared on the soiling system. I shall keep them the first few months in a small inclosure of less than an acre, for the convenience of feeding them, rather than have them in different houses. I do not consider I gain any thing but convenience by it.

If I can bring my cattle to the butcher at two years old, they will pay me well. I am feeding at present my dairy on mangel-wurzel. I am inclined to think it does not answer so well for milk as for fat. It is of an astringent quality, which operates against milking. The person who has superintended one of my dairies, made the same observation on the tops or leaves. It is, however, a most valuable root. I can keep it good to any time. The roots pulled before frost answered better than those which remained in the ground till March. I am dubious as to fiorin grass, not that it is not an admirable and valuable grass when it can be secured in the exclusive possession of the ground, but except on peat bog, where there is no existing seeds of vegetables, I do not know how this is to be done. The springing of other grasses destroy it. I have some acres that I fear will fail on this very account.

I shall send you shortly an account of my proceedings in burning clay for manure. I expect to have one hun-

dred acres of wheat put in by it, and sixty bushels of lime. It is the sole mode of bringing the bog into cultivation in Ireland; and is practised with success to a great extent there. I cannot reconcile to myself, or fix on any principle, to which to attribute the superior fertility of the Irish soil. Six or eight crops running, without manure, and after all the land is in a state for bearing grass. Their rents far exceed ours. Six pounds the English acre very common, paying tithes. I have 400 acres of wheat this year, of new-inclosed waste land, and the crop is looking very well.

I have sold my larch bark for ten pounds *per* ton, and it is much approved. This will give a decided preference to larch over every other species of wood.

I find larch to answer for the handles of picks, but they will not bear great strain. We have found it best to saw them from the blocks.

A Certificate confirming the above statement accompanied this communication.

Method of producing new Potatoes throughout the Winter Months. By Miss ANN CLAGUE, *of Chester.*

From the TRANSACTIONS of the SOCIETY for the ENCOURAGEMENT of ARTS, MANUFACTURES, and COMMERCE.

The Silver Ceres Medal was voted to Miss CLAGUE *for this Communication.*

I PREPARE a proper quantity of red sand, rather of a loamy nature, and mix up with it a proportion of lime in powder, *viz.* about one-third or one-half, about fourteen days before I use it.

This

This soil is to be spread about three inches thick, at the bottom of any old wooden box, or even on a very dry brick cellar-floor. The cellar ought not to be exposed to the frost, nor yet too much confined from the air. I then procure a measure or two of large potatoes, of a prior year's growth; the sorts I prefer are the red apple potatoe, the pink eyes, or Mr. Curwen's purple potatoes. I set these on the soil whole, about three inches apart, with the crown or principal eye to the soil in preference, but I put no soil over them. The potatoes which I sent the Society were produced from potatoes thus placed about the 20th of September, which allows from ten to twelve weeks for their growth; they grew at the bottom of the old potatoes, and were attached to them.

The old potatoes also threw out numerous sprouts or stalks, with many potatoes growing on them, but these sprouts were killed by the very intense frost of the present winter (1814); and as I found them to damage both the new potatoes and the old sets, I removed them. I have no doubt but that these sprouts would have produced a crop of potatoes if the frost had not damaged them.

The original potatoes for planting whole for sets in September should be such as were of perfect growth in the October of the preceding year, and well preserved during the Winter; the sprouts which are shooting from them should be removed by the end of April, and these sprouts, which will be from six to twenty inches long, may be planted with all their fibres in a garden, for a first crop. About June 15th the potatoe-sets must be sprit again, and the sprouts planted for a second crop; and in September the potatoe-sets must be sprit a third time, and the sprouts of this last produce thrown away

as useless. At the end of September the original or seed-potatoe is to be gently placed on the soil, as before mentioned, for a Christmas crop. At the end of three months at farthest, the old potatoes should be carefully twisted from the new ones, and the sprouts taken off the old potatoe, and the old potatoe is then to be placed on its bottom or side, on a fresh bed of soil, prepared as before, and left to produce another crop from fresh eyes placed next the soil, as you are to observe, that the old potatoe should not be set or placed twice on the same side, and you must take care at that time to remove the sprouts, to prevent this moisture rotting the old potatoe.

By the above method of planting and turning the old potatoes I have had four crops of new potatoes from one potatoe, exclusive of those crops produced from the sprouts planted out in the garden in April and June.

The produce from one bushel, of about eighty pounds weight, has been already about thirty pounds of new potatoes of good quality, but the bushel must have lost considerably in weight from the sprouts and stalks thrown out and removed at different times.

If any of the old potatoes should prove to be in a decaying state they should be removed immediately, as worms and a black fly would be otherwise apt to damage the whole.

I must beg leave to observe, that from the sprouts taken from the seed-potatoes in April and June last, and planted in a common garden; I obtained two crops of good well-grown potatoes, in September and October last, weighing from eight to twelve ounces each potatoe; the crops were very plentiful in proportion to the quantity planted.

On examining the potatoe-bed in my cellar, about three weeks past, I found the frost had penetrated there, and

and the thermometer as low as 30 degrees; but in general it has been from 35 to 40 degrees, in the last two or three months.

The greatest weight of any of my new potatoes has been two ounces and a half, but they run in general from half an ounce upwards.

The sprouts which were injured by the frost at Christmas, and thrown away, were produced from ten pounds of potatoes; they had hundreds of small potatoes attached to them, but nearly all spoiled by the frost.

My seed potatoes have been tried on two sorts of soil; one in the proportion of one-fourth lime and three-fourths loamy sand, and the other from equal parts of each. From the *first* more sprouts were thrown out, but the *potatoes* were not so firm and dry as from the latter.

Dr. W. W. Thackeray, of Chester, certified that he had seen the potatoes in a growing state, and that the annexed particulars contain an accurate account thereof.

*** The Committee are aware that new potatoes are frequently collected from amongst the sprouts of old potatoes laid in heaps in cellars during the winter: but their taste is usually earthy and unpleasant. They know also of various other modes of raising them early, but they believe none will be found more cheap, and easy in management, than Miss Clague's method; the potatoes being remarkably well-flavoured, and may be kept longer without prejudice after gathering, before dressed, than new potatoes grown in the natural ground.

Method

Method of making a double Piston-pump, yielding double the usual Quantity of Water from the same Bore.

By Mr. PETER HEDDERWICK, *of Lower East Smithfield.*

With a Wood Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal and Twenty Guineas were voted to Mr. HEDDERWICK *for this Invention.*

I BEG leave to state, that I have made a considerable improvement in the working of ships' pumps, and that I wish to submit the utility of this invention to the Society of Arts.

REFERENCE TO THE ENGRAVING.

Figs. 1, 2, and 3, represent three methods of fitting up these pumps, but as they have nothing peculiar in them, the description will be confined to that part wherein consists the novelty of this invention.

In the pumps with double pistons hitherto made, the piston rods have been attached to one side of the pistons, whereby giving an unequal pull upon the pistons, whereas in this contrivance they are attached to the centre of the piston, the lower piston rod passing through the centre of the upper piston.

The method of doing this is more particularly shewn in Figs. 4 and 5. In Fig. 4 K K D D is part of the piston rod of the upper piston, with two branches D D, jointed at D D to the piston F F.

G G is part of the piston rod of the lower piston, passing through the cross bar F F, which is attached to the

pot

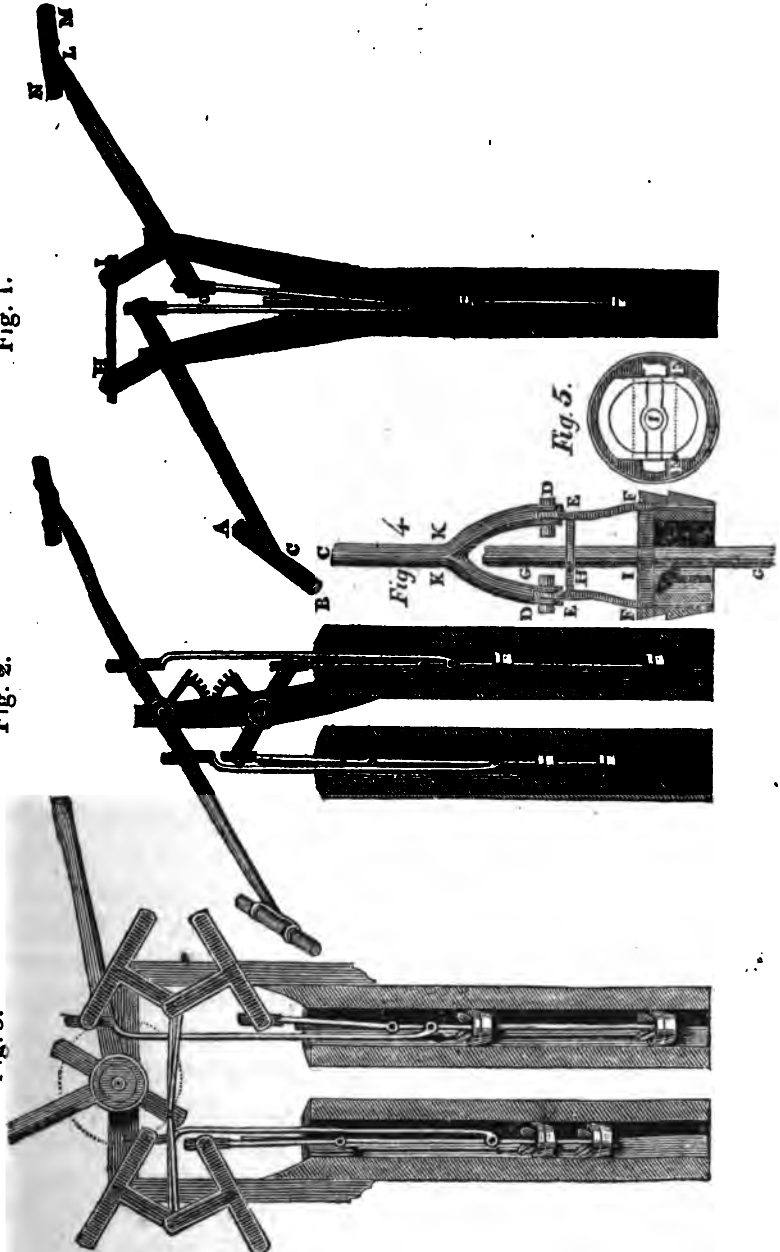


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4

Fig. 5.

top of the upper piston; E E is another cross bar, by which the piston rod G G passes.

The jointed piston, as here shewn, is only necessary in large pumps. In smaller ones the joint D and the bar E E may be dispensed with, and thus the piston rod may be all in one piece, fastened to the top of the piston box at F F, the pliancy of the rods rendering the joint at D needless.

Fig. 5 represents the top of the piston, with the cross bar F F, through which the lower piston rod G G, Fig. 4, passes at I. The two valves are formed of one piece of leather, in the usual manner, which is confined under the bar or cross piece F F, and is strengthened by having two plates of iron rivetted upon it, one on each valve, the valves being what are usually termed butterfly valves.

The principle will appear from the manner of working the pump, as follows:

In Fig. 1 A B C D H is a handle or bent lever upon one side, and M N L K I a similar one on the other side of the pump, by which the power is communicated to the pistons; the lever A B C D H is moveable round the fulcrum or centre D, and the lever M N L K I round the centre K; the extremities I and H are connected by a bar I H, so that when the end of the one lever, A B, is depressed, the other, M N, is raised; the straight parts C D and L K of the levers are continued to E and O, beyond their centres of motion D and K, so as to be as nearly over the centre of the bore of the pump as possible, but free of each other in the operation of working.

By this connection, when the handle A B is depressed the handle M N is raised, the piston G is depressed and the other piston F raised. This motion being reciprocally continued, gives a double advantage in lifting the water; for when the one handle is pulled down the piston attached

tached to that handle is raised, and when the same handle is raised up, the piston belonging to the opposite handle is also raised.

Figs. 2 and 3 represent two other modes of working this pump, but for the reasons above given they need not be particularly described.

*** From the construction of this pump with two pistons, it appeared evident, that the pump barrel would raise twice as much water in the same time as two others of equal bore with one piston each; a benefit of sufficient importance in many cases of accidents at sea, but upon a comparative trial before the Committee of Mechanics, it turned out, that the pump with two pistons actually raised *twice and a half* as much water as another pump with one piston only, which was connected with it, so as to make equal strokes therewith, did in the same time; a difference in favour of the pump with two pistons so remarkably great as to occasion doubts in the minds of the Committee, whether the pistons or bore of the double piston pump might not have been more accurately formed than in that with a single piston; on this account they shifted the pistons from the one barrel to the other, but on repeating the experiment the result was the same as before; a convincing proof that the experiment was a fair one, and, in fact, the difference in the effect of the two pumps can be perfectly well accounted for, by the consideration, that in the pump with a single piston, the water, after being put into motion by the action of the pump, is suddenly stopped by the change of motion during the descent of the piston, and has to be again put into motion at every stroke of the pump, to the great hindrance of the regular discharge of the water; whereas

in

in the pump with two pistons the flow from it is nearly continual during its action, the one piston constantly ascending whilst the other is descending, and the momentum of the water continuing its ascent during the change of motion in the pistons, and thus producing the very great difference in favour of the performance of the pump with two pistons; neither does this pump ever require double the force that is applied to one with a single piston to work it, it being much easier to continue a motion when commenced than to renew it perpetually when interrupted as it is in the pumps with one piston only.

Method of making a double Spring to a Door, enabling it to open inwards or outwards.

By Mr. J. STONE, *of Warwick-street, Golden-square.*

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal and Five Guineas were voted to Mr. STONE *for this Communication.*

HAVING invented a double swing door spring, I have herewith sent a model of a door hung upon this principle, which I submit to the Society of Arts, &c. for their inspection.

REFERENCE TO THE ENGRAVING.

Fig. 1 (Plate II.) a double spring affixed to a door, by which it opens equally well inwards or outwards. *a b,* Fig. 1, two barrels, containing two spiral springs on one axis, wound contrary ways: this axis is squared into the spring frame *c c,* to keep it from moving round, and at

at each end is a pivot, which enters into the door: these pivots keep the door from being forced away from the springs, so that their action is always certain. Two brass plates *d d* are screwed on the door to receive the pivots: the pivot holes are open at the back, as in Fig. 2, which is needful, to get the door on to the springs; for the springs being first screwed on the door-post, the door is opened at right angles to the door-frame, and then slid on. The door is hung on pivots; the bottom pivot is fitted into the door at *e*, and the top pivot is rivetted into a plate of iron screwed upon the top of the door, and enters the door-frame at *f*. The pivot lower hole is of brass, and screwed in the floor, coincident with the axis of the springs. The hole is turned a little wider at the bottom, to hold oil. There are stops on each barrel, *k l*, Fig. 3; the stop *k* is on the lower barrel, as Fig. 1, and prevents the spring from acting farther than to shut the door, and the stop *l* on the other side of the upper barrel is to prevent the spring from acting farther than to shut the door the other way, by which means the springs remain wound up enough to hold the door when shut with the required firmness. *m m* are plates screwed on the door after it is hung, to catch in the hooks *o* and *p*, by which the springs act on the door; when the door opens on the side *n* it carries round the barrel *b*, Fig. 1, by the hook *p*, Fig. 3, as shewn by dotted lines, and when open on the side *m* it carries round the barrel *a*, Fig. 1, by the hook *o*, Fig. 3, shewn also by dotted lines. These springs being thicker than the door, the extra thickness is let into the spring plate and door-post, as shewn in Fig. 3, and by dotted lines in Fig. 1, by which means the door lies flat against the door-post when open.

A Cer-

A Certificate was received from Mr. J. Tomkins, of Bevis Hill, Southampton, dated February 1814, addressed to Mr. Stone, informing him that he had remitted him 2*l.* for one he had received, and that he thinks the invention a very good one, and such as must succeed.

*** The Society, besides having in their Repository a model of Mr. Stone's double door spring, have likewise had one of the doors of their house, which is most frequently used, hung in the above manner, with one of them affixed to it, as a farther proof of its efficacy, and with the most complete success.

Method by which Sash-Windows can be cleaned or painted without Danger to the Person employed.

By Mr. C. WILSON, *Worcester-street, Borough.*

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

Five Guineas were voted to Mr. WILSON *for this Communication.*

I BEG leave to lay before the Society of Arts, &c. my invention of a method by which sash-windows may be so hung as to be cleaned or painted without danger to the person employed. By this means many lives may be saved, and accidents prevented, besides a general advantage arising to the public.

REFERENCE TO THE ENGRAVING.

Fig. 4 (Plate II.) is a section of a sash-window frame, the sash-lines having rings fastened to them to hook on to

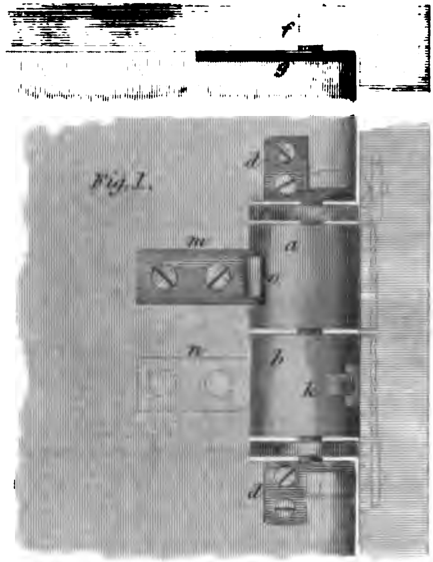
to or off the head of a screw placed in a hollow made in the side of a sash, as at *q* and *r*, at the bottom of the grooves which are also made in the sides of the sash for the line, and each screw head is flush with the surface, so that the rings cannot get off whilst the sash is in its place; *s* and *t* represent the lower halves of the bead and middle slip, one of which will stick in its place, and the other can be fastened by the screw *v*; these will take out, so that both the sashes can be taken into the room, and the sash-line separated from them; and they may there be cleaned or repaired without the dangerous trouble of going outside the window. *w w* is a section of the sash and pulley shewing the ring of one of the lines hung upon the head of the screw in the hollow of the sash, as before described.

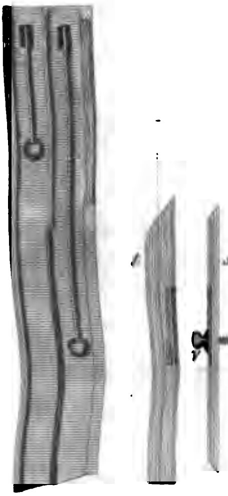
An easy Method of destroying the Blue Insect that breeds on the Bark of Wall Trees, and causes them to canker and die. By Mr. PETER BARNET, *Gardener to Lady Elcho, at Amisfield.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

IN May 1807, when I entered as Gardener at Alderstone, near Haddington, many of the wall trees were infected with the blue insect. In particular, there were two golden pippin apples so overrun, that I was going to throw them out, or at least to cut them over, and re-engraft them in the following Spring.

During the Winter, however, I resolved to try an experiment for the destruction of the insects and their eggs. I collected a considerable quantity of chamber-ley; and when it had been kept for several weeks, I one afternoon





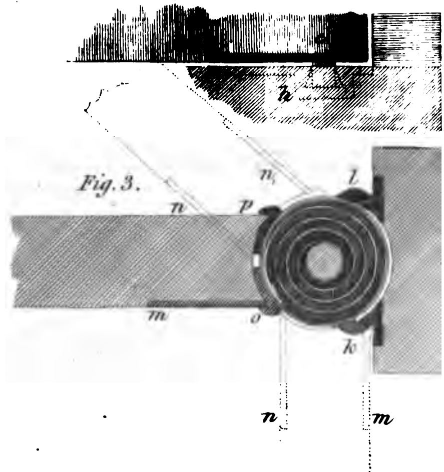


Fig. 4.

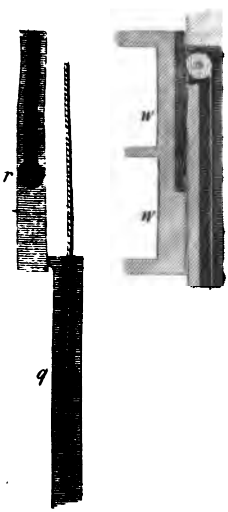
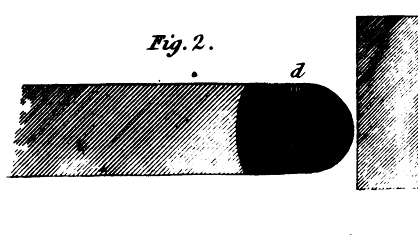


Fig. 2.



afternoon unnailed the affected trees, and with the garden engine washed them with the stale ley. It was after sunset, and so hard a frost, that the liquid was soon converted into ice upon the branches. I nailed the trees again to the wall, and at this time took no farther notice of them.

In the following summer, the trees made fine wood in every part; and the next year again, (1809), they bore the best crop that I ever saw; and they are now a healthy as any trees in the garden. A few of the vermin, indeed, still appeared, which had lain concealed about the spurs; but where the stems were clean, there were none to be seen.

I intended to have repeated the experiment on the same trees during the past winter, as the insects seemed again to be on the increase: but my removing to Amisfield in November last, has prevented it.

Here, however, I have ample room for the same sort of experiment; as nearly one-half of the trees in this garden, are affected, and severely injured by the same insect. I intend to have recourse to the above remedy; and shall communicate the result.

Meantime, as the experiment is very simple, and within the reach of every one, I thought it best to communicate it without delay to the Society.

Additional Remarks by Mr. Barnet.

In the course of winter 1811, I repeated the experiment with chamber-ley on several fruit-trees here; and have since had the satisfaction to find that they are entirely freed of the blue insect. It does not appear, however, that the applying of the liquor in the time of frost, is necessary to its success; trees washed in fresh weather, being equally cleaned by the application.

On destroying Wasps.

By Mr. JOHN MITCHELL, Moncrieff House.

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

HAVING been much troubled with wasps at this place, I have made trial of several methods to keep them under. Destroying their nests is most efficacious; and the following simple way of doing so, I have practised for several years past, and find it most beneficial.

The method I take to find out their nests, is by observing, in a quiet sunny day, the course of the flight of the wasps from the garden, following them as far as I can observe them flying; then waiting till others pass the same way, following them likewise; and so on until I reach their habitations. Having marked the place; in the evening, when I think they are all in, I come provided with a lantern and candle, and a match of damped gun-powder, made in a roll on the end of a small piece of wood; I light it, and it burns like a squib; and introducing it into the hole, I put my foot on it for a few minutes. I then dig until I see the works, and having a panful of water ready, I throw it upon them, and work it all together like mortar. When the nest happens to be on a bush or tree, I hold the match below it, when the wasps soon fall stupified to the ground, and are destroyed in the same way as above.

When I began to destroy wasp-nests in this way, I have in one season, and within 300 yards of the garden, destroyed upwards of fifty nests, without getting a sting, or passing a single wasp. They are every season diminishing in number, and I have not the smallest doubt, if every gardener were to use the same method, a great

many

many fine fruit would be preserved, as well as honey-bees, which are much destroyed by wasps.

In the common way of hanging up phials against trees, a great many wasps may be enticed into them; but still the hive is breeding more. Large white glass phials, however, are useful for destroying the *large black flies*, which are likewise very destructive to peaches. I put a little jam or jelly into them; I find it has a good effect to entice them into them; and this is the only method I have found to keep them under.

On destroying Caterpillars, removing Mildew, &c.

By Mr. John Kyle, *Blair Drummond.*

From the Transactions of the Caledonian Horticultural Society.

As to the caterpillars on gooseberries, I have tried many ways. The only way that I got the better of them was to take them at the first appearance, which is seen by small holes in the undermost leaves; pick off these leaves, which is soon done. I have commonly had to go over them a second time; but by so doing I always preserve the fruit and the bushes from being hurt.

But now I have fallen upon a better way. When the leaves are fully out go to the cow-dunghill, and take the cow-urine; water round below the bush, on the surface of the ground, but not on the bush; it will improve your crop, and free you of caterpillar.

The *Mildew* on peach trees is occasioned by a very destructive insect. I was very much hurt with it here, and tried several ways, but could not get clear of it till I watered the borders with cow-urine; and for nine or ten years I have not had the least appearance of it. I

give them a watering at the winter dressing, end of November, or in December, and then another after they set a-growing. I likewise do the same to the vines, and I never miss a good crop.

As to *Hot-beds*, I make the beds with moss and dung; I take the dung new from the stables: lay first about a foot and a half of dung, then a stratum of peat-moss about four inches, and then dung about six inches, moss four inches, and dung, and so on till I make the bed a proper height, giving allowance for sinking; and in less than three weeks it is ready for the seed or plants. I have used this method for several years with great success, and it makes fine manure. The moss must be broke small, but it is not to be expected that every gardener has it in his power to get proper moss.

Composition of an unchangeable Cement.
By M. THENARD.

From the BULLETIN of the SOCIETE D'ENCOURAGEMENT.

THE following cement has been used with great success in covering terraces, lining basins, soldering stones, &c. and it every where resists the filtration of water; it is so hard that it scratches iron. It is formed of 93 parts of well burnt brick or clay, and seven parts of litharge and of linseed oil. Nothing can be more simple than its composition or the manner of using it. The brick and litharge are pulverised, the latter must always be reduced to a very fine powder; they are mixed together, and enough linseed oil added to the mixture, to give it the consistence of thin plaster. It is then applied in the manner of plaster, the body that is to be covered being always

always previously wetted with a sponge. This precaution is indispensible, otherwise the oil would filter through the body, and prevent the mastic from acquiring the desireable degree of hardness. When it is extended over a large surface, it sometimes happens to have flaws in it, which must be filled up with a fresh quantity of the cement. In three or four days it becomes firm.

On tempering Copper.

From the BULLETIN of the SOCIETE D'ENCOURAGEMENT.

IT has been supposed, that the ancients by tempering their copper, gave it a degree of hardness equal to that of steel; but it appears from the experiments of M. Mongez, of which he gave the details in a memoir which he read to the Institute, that the immersion of copper in cold water when red hot causes no sensible change in the metal, as far as relates to its hardness or softness; and that besides, if the ancients did possess the art of hardening copper, it was not by any mixture of iron or arsenic, since in the antique copper instruments which have been analysed with the utmost care, no arsenic has been found, and the small quantity of iron that was met with, did not exceed what is frequently contained in the copper of commerce.

As to the bronze, which is formed by a mixture of copper and tin, the effects of tempering it are not the same, as the facts discovered by M. D'Arcet tend to prove.

This able chemist having found by analysis the composition of the metal of which the cymbals are formed, that are manufactured exclusively at Constantinople, he made

made some which at first appeared to be similar to them, but when he attempted to finish them, they fell to pieces. After several fruitless trials, he discovered that by making the bronze red hot and tempering it in cold water, he could render it so soft as to bear working without trouble, as well as polishing, chasing, engraving, &c. It was easy afterwards to restore it to its original hardness, by heating it again, and suffering it to cool slowly.

This discovery has been applied to the manufacture of bell-metal, by which it is thus made to bear the strokes of the clapper, and without this precaution the metal shivers and is split by the pressure.

M. D'Arcet has made cymbals, and other similar instruments of percussion, of as good quality as they were formerly made in the East.

The Institute, in consideration of the labours of M. D'Arcet, has resolved to add the art of manufacturing metallic instruments of percussion to those already published by the society, requesting M. D'Arcet to take the charge of editing it.

Method of making a Pellicle composed of Milk and Vinegar which may be used in Writing, Printing, &c.

From the BULLETIN DE PHARMACIE.

THIS pellicle is obtained by the mixture of two parts of milk with one of vinegar, which is exposed to a degree of heat sufficient to coagulate the milk. The liquor is then filtered through paper and produces an acid which is tolerably strong, and perfectly colourless.

This vinegar retains its transparency and limpidity until the eighth day; it then becomes turbid; it clears again

again after some days, but not perfectly, and precipitating a whitish sediment; the liquor then acquires an appearance similar to whey, not well clarified. The twelfth day, certain filaments form on the surface, which adhere to the sides of the vessel, and converge to the centre until they form but a single body:

From that time the substance acquires a degree of consistence, and before the thirtieth day, is as thick as about twenty-two millimetres and a half. In this state, it is taken out of the vessel and spread upon paper to dry. This substance which is nearly six lines thick, becomes as it dries thinner than gold beaters' skin, and cannot be broken without force. It sticks so hard to the paper, that it would tear, if the paper were not moistened when it is detached from it.

This pellicle being insoluble in water at any temperature, unalterable in the air, and resisting many agents and re-agents, appears to be susceptible of application to various purposes. It bears characters of writing and printing; its transparency renders it proper for covering pictures and other valuable objects, it may also be used for tracing, and instead of fine parchment; but in dry weather it will hardly fold without breaking.

Account

Account of the Method used in Germany for polishing Wood. By M. MARCEL DE SERRES.

From the ANNALES DES ARTS ET MANUFACTURES.

IN the first place the Germans are careful to join their wood very neatly, and to make the surface very smooth, because if the varnish brings out the beauty of the wood, it does the same by the defects. When the wood is once well polished they prepare the varnish.

For this purpose, they reduce to a powder some of the purest shell lac, that is to say, very transparent, and dissolve it in well-rectified spirits of wine; they add in a retort, double the quantity of alcohol to the lac employed, and expose it to a heat of about fifty degrees Reaumur. They are careful to agitate the mixture every three hours, until the varnish has acquired the suitable consistence; if it does not appear of a sufficient consistence, they add a little more pulverised lac; if on the contrary it is too thick, they mix a little more alcohol, being careful to agitate the mixture until it is of the right thickness.

This varnish has no peculiar quality, except that it contains no turpentine, nor any other body that renders the varnish gluey, and liable to crack.

They apply the varnish with a piece of fine linen, which is formed into a sort of pallet. The workman is previously provided with a mixture of two parts of varnish to one of olive oil, in which he soaks the linen, and then rubs it over the surface of the wood with great force, and pressing very hard upon it, but always in the direction of the fibres of the wood.

He begins afresh, by moistening the wood again, until the whole surface of the wood is covered with a

slight coat of varnish. When the wood is well moistened with the varnish, they leave it to dry, which it does very quickly, and they then apply a second coat, a third, and even a fourth if necessary. When the varnish is perfectly dry and hard, they give it the lustre in the manner following.

They steep a piece of fine linen in a mixture of olive oil and tripoli reduced to powder, and rub the wood hard with it until the varnish has acquired the proper degree of brilliancy. Then to give it the last polish, they rub it with a piece of very soft linen or very fine soft leather.

This varnish may also be applied with a brush, on bodies that do not offer an even surface, only it must then be made thinner by adding a greater proportion of alcohol. It may afterwards be polished in the manner above described.

When it is applied to bodies of great surface, it is essential that the varnish be made as thin as for bodies in relief, because as it dries quickly, the edges of the parts that are first laid on would acquire a degree of thickness, which could not be reduced in the polishing.

Lastly, articles that are turned in wood, may be varnished and polished in the same manner even in the lathe.

The only inconvenience attending this varnish is, that it gives the wood a brownish colour, which is no inconvenience where a deep colour is desired; and for which reason it is much used in varnishing mahogany and the walnut and cherry-tree woods. But when the wood is to be kept of a light colour, the varnish is made in the same manner, only instead of the lac, they use copal gum dissolved in the alcohol, adding to it sometimes a little camphor or ether. This varnish may be applied with success to many different sorts of wood.

Some of the Vienna makers, dissolve the copal by exposing it to the action of the vapour of alcohol, and sometimes they colour the copal varnish, which is naturally colourless, with any tint they wish to give to it; and they do not seem to use any spirits of turpentine to dissolve the copal.

By this method of applying varnish to wood, it penetrates so completely into the grain that is almost impossible to crack it. So that when scraped even with a sharp instrument, if the traces be not very deep, the polish may be restored by hard rubbing with a soft piece of linen.

The gluey varnishes have not this advantage, since they do not penetrate so deep into the substance of the wood, and a scratch will take them almost clean off, in such a manner that no friction will restore the polish.

Notice on some Chemical Processes employed in Holland.

From the Bulletin de la Société d'Encouragement.

M. GUYTON MORVEAU has presented to the Society a German work, intituled, "Description of some Manufactures from Chemical Products, and Mineralogical and Technological Observations made during a Tour in England and Scotland by M. Feber, counsellor of the Mines to the King of Prussia, and member of several learned Societies, &c."

This work, which was published in 1793, contains a very succinct account of some chemical processes employed in Holland, and which the author collected during his stay in Amsterdam in 1769. He visited the principal manufactories in that town, and has followed the operations

tions practised in them. We may therefore place some confidence in the processes he describes, and although the arts have made great progress since the period of the author's travels, we do not hesitate to publish two of these processes, the refining of camphor and the sublimation of cinnabar or vermilion, because they are least known, and the Dutch practise them exclusively. We do not, however, by any means pretend to vouch for the accuracy of these processes, which may probably require to be repeated; it remains for experience to establish their advantages.

Method of refining Camphor.

It is well *known* that camphor comes from India in *little balls* or masses, commonly charged with great impurities and packed in cases. The Dutch are the only people who now purify or refine it.

Camphor might be sublimed alone and without any mixture; but as it is always mixed with hairs and wool, and fragments of wood and straw, and as these substances disengage during the sublimation an empyreumatic oil, which would give a yellow colour to the camphor, they usually add some lime or chalk, in the proportion of two ounces to the pound of camphor. After the mixture is effected in an iron mortar or a small hand-mill, they put about two pounds and a half in weight of it, into each subliming vessel. These are black glass bottles, with large necks and of a round form, a certain number of which are placed near each other on a sand bath over a stove appropriated to this purpose; they are sunk into the sand to the depth of some inches, and are slightly stopped with cotton or tow; underneath each sand bath is a fire-place and ash-hole; it is heated every morning with turf reduced to charcoal, in sufficient quantity to

last the day, for every operation is completed in a day. It is begun by making a brisk fire, in order to put the camphor in a state of fusion; the vapour that is disengaged rises in the neck; it would fall down again in drops within the vessel and cause it to burst, if this inconvenience were not prevented by covering each bottle with a conical cap of tinned iron, which is charged with warm sand, and under which the camphor is collected. By this method, there is no loss even if the bottle break. When the camphor is liquid enough, and all the humidity it contains has evaporated, they take off the sand above the cap, and often even the cap itself; but they immediately replace it by a fresh one, having a hole in the middle, for the admission of an iron tool to stir the mixture contained in the vessel. The camphor as it volatilises adheres to the sides of these caps, where it forms a transparent mass. All access from the external air must be carefully prevented.

While the caps are changing, and at the moment when the sublimation commences, the fire is diminished. It is kept up all the day at a suitable heat, and moderated, if necessary, by means of registers adapted to the stove. From time to time the workman lifts up the caps and the cotton stopper, in order to reach the bottom of the vessel with an iron rod, intended to open the passage of the neck, which the volatilised camphor tends to obstruct; towards the end of the operation the caps are taken off entirely.

They perceive that the sublimation is terminated when the camphor begins to melt on the sides of the vessel; the bottle is then taken from the sand bath and left to cool, and they break it in order to obtain the loaf of camphor, which they wrap in blue paper. There still remains much camphor attached to the fragments of

glass;

glass; and as it would be too troublesome to take it off with a knife, they throw the fragments into a very deep copper boiler, which they cover with a round cap of the same metal and place it on a stove; the camphor as it volatilises adheres to the sides of this cap, from which it is easily removed.

Sublimation of Cinnabar or Vermillion (red sulphuretted Oxyd of Mercury).

In the establishment which M. Ferber visited, they sublimed the vermillion in thirty-six or forty-eight hours, in large vessels, each of which contained 170 pounds of mercury and 50 of sulphur. These are the proportions that were described to him; the proportion of mercury however might be augmented, and the cinnabar would then acquire more brightness.

They begin the operation by melting the sulphur in a large iron kettle, the mercury is added to it by degrees, and they mix the whole with an iron spatula; they then pour the mixture upon cast-iron plates, placed in the air, and when it is cool separate it into small portions, which are put into little stone pitchers. The large subliming crucible or vessel, is made of white pipe-clay to resist fire, and glazed on the inside with common potters varnish; it is of a round form and a little widened, the edge is made flat, to receive a lid or iron plate, and it is about five feet high. The crucible enters the stove to nearly half its height, and is thus exposed to the immediate effect of the heat. It is surrounded by a large iron ring, placed flat-ways upon three bricks fixed at equal distances on the edge of the stove by means of a little clay.

This ring serves as the base to a very thick layer of pipe-clay, mixed with chopped wool and covered with iron filings, a portion of which surrounds the part of the crucible

cible that stands out of the stove; the upper edge of this layer forms a trench into which the cinnabar falls, which escapes out of the crucible notwithstanding the lid which covers it. These preparations being completed, they heat the stove with turf, and augment the fire by degrees until the bottom of the crucible is red; they then throw into it the mixture contained in two of the small pitchers before mentioned; at first it crackles as it burns; when the workman judges that enough of the sulphur is burned, he covers the crucible with a very thin plate of cast-iron; the flame is immediately extinguished, and the cinnabar begins to sublime.

In order to be certain that the plate fits closely, they pass over it a stick, to the end of which a ducat is attached; if the vessel be not well closed, the gold becomes white. From time to time they lift up the lid with a pair of iron nippers to let the vapours escape, and to let the fresh air penetrate into the crucible, that it may not break: the cinnabar fixes on the edge and under the lid, as being the least warm place; when the workman judges that there is enough of it, he takes off the lid carefully and detaches the cake of cinnabar with a pointed hammer, at the same time he puts upon the crucible another plate, to which a fresh quantity of cinnabar adheres. The coolness of this lid and the upper part of the crucible, greatly favour the sublimation. At the end of three or four hours, according as the operation is more or less accelerated, they stir the mixture with a thin stick, to keep it from burning, and they cast a fresh quantity of sulphur and mercury into it until the whole is sublimed. They then extinguish the fire; when the stove is cold they take off the crucible, and scrape the cinnabar which may happen to remain on its sides. They afterwards detach the loaves of cinnabar from the plates, and preserve

serve them entire for the sake of dispatch, or else they break them.

Winter is more favourable than summer for the sublimation of cinnabar, because the upper part of the vessel is cooled by the external air. These vessels will serve for several operations.

The cinnabar is pulverised at Saardam, where there are a considerable number of mills for grinding colours, dyeing woods, &c. The operation is performed, by placing it between two horizontal mill-stones, which vary in thickness, hardness, and are placed more or less close together, according to the degree of fineness desired. The operation is repeated three or four times by moistening the pulverised mass with pure water. It is said, that *the colour* of the cinnabar is so dazzling, that a particular *sort* of glasses are necessary to distinguish its different qualities without injuring the sight.

The finest serves for making sealing-wax. They frequently mix it with minium.

List of Patents for Inventions, &c.

(Continued from Vol. XXVI. Page 384.)

Samuel John Pauley, of Charing Cross, in the county of Middlesex, Civil Engineer, and Durs Egg, of the Strand, in the same county, Gun Manufacturer; for certain aerial conveyances, and vessels to be steered by philosophical or chemical or mechanical means, and which means are also applicable to the propelling of vessels through the water, and carriages or other conveyances by land. Dated April 25, 1815.

Jacob Wilson, of Welbeck-street, in the parish of St. Marylebone, in the county of Middlesex, Cabinet-maker and

and Upholsterer; for certain improvements in bedsteads and bed-furniture Dated April 27, 1815.

WILLIAM BUSH, the younger, of Saffron Walden, in the county of Essex, Surveyor and Builder; for a method for preventing accidents from horses falling with two-wheeled carriages, especially on steep declivities; superior to any hitherto known or in use. Dated April 29, 1815.

PETER MARTINEAU, junior, of Canonbury-house, Islington, in the county of Middlesex, and JOHN MARTINEAU, junior, of Stamford-hill, in the said county, Gentlemen; for their new method or methods of refining and clarifying certain vegetable substances. Dated May 8, 1815.

CHARLES PITT, of the Strand, in the city of Westminster and county of Middlesex; for his method or methods for the security and safe conveyance of small parcels and remittances of property of every description, and also for the security in the formation or appendage of shoes. Dated May 11, 1815.

SAMUEL PRATT, of No. 119, Holborn-hill, in the county of Middlesex, and of No. 40, Holborn-hill, in the City of London, Trunk-maker; for a wardrobe trunk for travellers. Dated May 11, 1815.

JOHN JAMES ALEXANDER MACCARTHY, of Arlington-street, in the parish of St. George Hanover-square, in the county of Middlesex, Sculptor; for a method of paving, pitching, or covering streets, roads, and ways. Dated May 11, 1815.

ARCHIBALD KENRICK, of West Bromwich, in the county of Stafford, Founder; for certain improvements in the mills used for grinding coffee, malt, and other articles. Dated May 23, 1815.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLVIII. SECOND SERIES. July 1815.

Specification of the Patent granted to WILLIAM SELLARS, *of Kimsey Elms, in the County of Worcester, Engineer; for a Method of spinning and laying of Ropes, Twine, Line, Thread, Mohair, Wool, Cotton, and Silk, by Machinery.* Dated June 7, 1814.

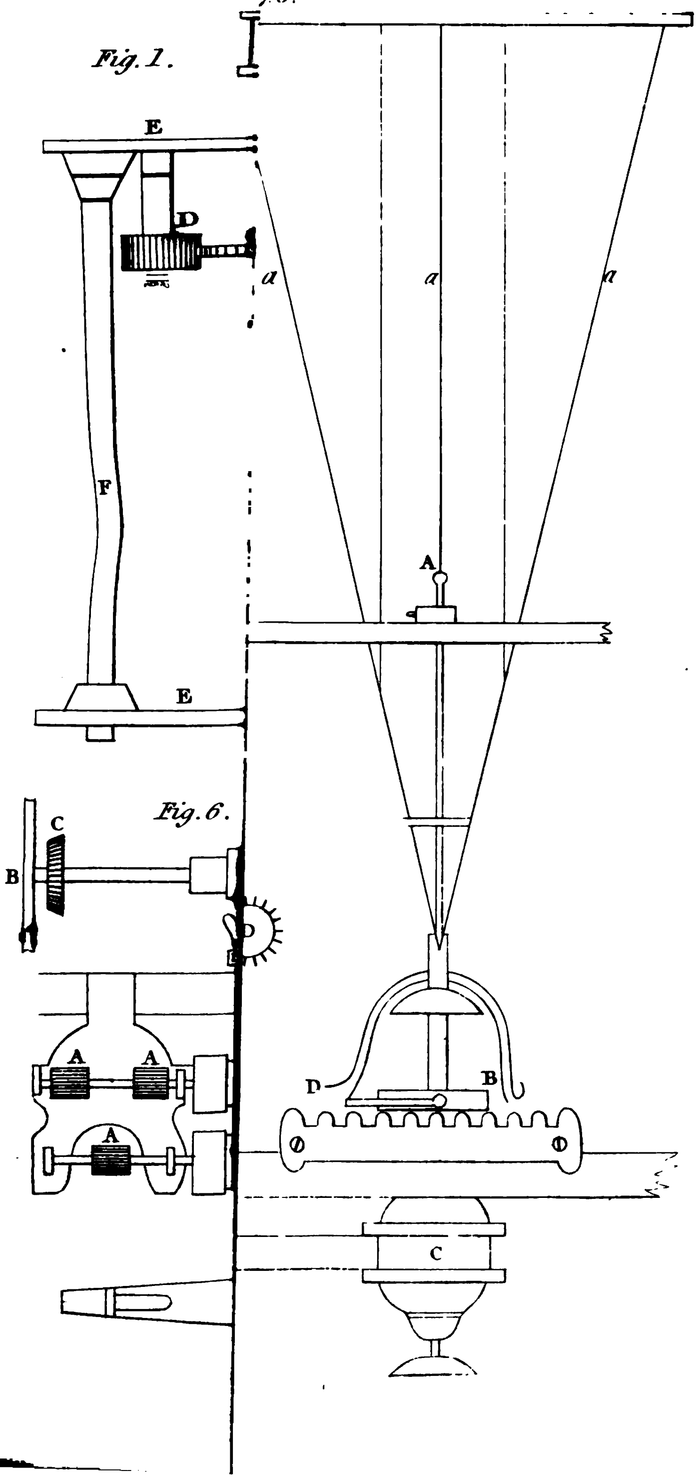
With a Plate.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said William Sellars do hereby describe and ascertain the nature of my said invention, and in what manner the same is to be performed, by the plans or drawings in the margin of these presents, and the following description thereof; that is to say: Fig. 1, (Plate III.) is the elevation of the frame and pillars containing the upper part of the machinery. A represents a pulley or wheel acted upon by means of a strap, or otherwise communicating motion to the centre perpendicular shaft marked B, on which is fixed a spur-wheel marked C, of an indefinite size according to the work intended; D D D are three wheels or pinions put in motion by the spur-

spur-wheel C; E E are two round (or square if necessary) plates perforated with holes, and the plates attached to each other by three equi-distant pillars marked F F F; between the pillars are placed the machines as described in Fig. 2, of which a front and side elevation are represented in the margin, and may be more or less in number according as the work may require. Fig. 2, A is a wheel or pinion immoveable, fixed on the lower plate of Fig. 1, marked E, round which immoveable wheel or pinion revolves the wheel B, fixed on a spindle or shaft marked C, on which spindle is placed a worm or wheel marked D, giving motion to the rollers marked E E, and to the spole above, marked F; G G are two springs bearing upon the axis of the rollers E E, and the rollers and spole are fixed in the brass or iron frame maked H H, Fig. 3. The material intended to be layed, marked *a a*, passes from the spole in Fig. 2, marked F, through the perforated holes in one or both of the plates in Fig. 1, marked E, and is received by the conductor in Fig. 3, marked A, from whence it is conveyed to a revolving spole marked B, which spole performs its evolution on the spindle or shaft marked C; D is a lever and spring which relugates the spole, and tightens or loosens the twist of the lay. Fig. 4, is the plan of the spur-wheel and pinions as described in the elevation of Fig 1, marked C D D D. Fig. 5, is a plan of the top of the machine in Fig. 1, marked E E, in which the pillars F F F are fixed. Fig. 6, is a plan of the same machinery to be put in motion by means of straps, in which case it may be necessary to introduce the additional rollers marked A A A, and which may be of any given size according to the material used: these rollers are put in motion by means of the upright shaft marked B, communicating with a bevel wheel or wheels marked C, which receives its motion from an horizontal

Fig. 1.

Fig. 6.



rizontal shaft; it may be also necessary in particular work to substitute, for the machinery in Fig. 2, three shafts or spindles, as shewn in Fig. 7, in the centre of which is placed a conductor, for the purpose of conveying the spun flax, hemp, thread, &c. to a receiving cylinder or spole. The manner in which the work is performed, is by placing or fixing spun flax, hemp, thread, mohair, wool, cotton, silk, or other materials intended to be layed upon the spoles, described in Fig. 2, marked F, or on as many of them as the work may require, and passing the several ends of the flax, hemp, thread, mohair, wool, cotton, silk, or other material through the perforated holes in Fig. 1, marked E E, or as many of them as may be necessary for the lay required; the ends are then carried through the conductor in Fig. 3, marked A, and wound round the receiving and revolving spole in Fig. 3, marked B. The machinery is fixed in any wooden frame of a convenient size, according to the bulk of the materials used, and may be worked by water, steam, or any other power.

In witness whereof, &c.

Specification of the Patent granted to HENRY HOULDSWORTH, *of Anderston, near the City of Glasgow, Civil Engineer; for a new Method of discharging the Air, or Air and condensed Steam, from Pipes used in the Conveyance of Steam, for the Purposes of heating Buildings or other Places.* Dated March 18, 1815.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Henry Houldsworth do hereby declare

 that

that my said invention is described in manner following; that is to say: My invention consists in the application of the force obtained by the expansion and contraction of the pipes conveying steam, or by the expansion and contraction of other pipes or vessels, bars or rods, connected with the pipes for conveying steam, to effect and regulate the discharge of the air, or air and condensed steam, from the steam-pipes aforesaid; and I apply this expanding and contracting force to regulators for discharging the air, or air and condensed steam, in different methods as circumstances may require, such regulators may consist of cocks or valves, or other machinery now commonly employed; my usual methods of applying the aforesaid force to the moving of these regulators are as follows:

First, let A B, Fig. 1, (Plate IV.) be a pipe for conveying steam, and used to warm any building or other place requiring heat; let the end B of the pipe press against the wall or other fixture: if the pipe is composed of a metallic or other substance, capable of being expanded by heat, it will on the admission of steam into it increase in length, so that the end A will have expanded to *a*, or approached nearer to it than it was previous to the admission of the steam; *b c d* is a bent lever moveable upon an axis at *c*; the end *b* of this lever, and the end of the pipe A, are connected together by a rod or link *b e*, furnished with joints at each end. From the pivot at *d*, on the end of the lever a rod *d f* is suspended, and upon which is fixed a valve *g*, and below this valve a weight *h*. The valve *g* fits when shut into a seat at *i*, in the valve box C. This valve box is fixed in the position shewn, and above the valve seat a pipe J K is joined, communicating at *k*, with the under side of the steam-pipe A B, at or near to the end A. Another pipe *l m*,

l m, joins the valve box below the valve seat. At *n*, is a stuffing box, through which the rod *d f* works. The apparatus being arranged as described and shewn in Fig. 1, on admitting steam into A B (by the pipe *o*), the end A will expand towards *c*, and by its connection with the lever *b c d*, the end *d* will be depressed, and the weight *h* being thus allowed to descend, will shut the valve *g*, and this will take place when the pipe A B is either wholly or partially heated, according to the adjustment of the apparatus, there being a screw at *p*, to lengthen or shorten the rod *d f*, according as more or less heat is required. The pipe J K is made of copper or other substance that will allow it to yield, as the pipe A B lengthens and shortens; its use is to convey the air, or air and condensed steam, into the upper part of the box C, above the valve. The pipe *l m*, is to convey away the air and condensed steam after it has passed the valve. When the pipe A B has expanded so much as to cause the valve *g* to shut, no more air or condensed steam can be discharged, and an accumulation of these will take place, which will cool the pipe A B in some degree, and in consequence it will contract in length and re-open the valve, and allow the air and condensed steam again to escape, when the steam (now supplying their places) will cause the pipe again to expand, and the valve will again be closed, and by a continuation of these operations, a regular discharge of the air, or air and condensed steam, will be effected. In adapting this apparatus to pipes used for the conveying of steam, I usually make the different parts proportional to the length and diameter of these pipes; that is to say, I make the valve *g* in diameter, from one-third to one-sixth of the diameter of the pipe A B; and the pipes J K, and *l m*, from one fourth to one-sixth of the said diameter; and I proportion

tion the two parts of the lever *b c d*, in such manner, that the motion of the pipe A B, when fully heated by steam, shall move the valve *g* through a space equal to twice or thrice its diameter; greater nicety in these proportions I have not found requisite, and I vary them occasionally as circumstances may require. The weight *h*, may be equal to fifteen or twenty pounds, or so much as to overcome the friction of the rod *d f*, in the stuffing box *n*, and shut the valve *g* with certainty.

Secondly, Fig. 2 represents a method of applying the expansive force aforesaid, to the discharge of air, or air and condensed steam, and which can be applied to steam pipes placed in an horizontal, or vertical, or any other position. A represents one extremity of the steam-pipe (the other end being fixed as shewn at B, in Fig. 1.), whether in an horizontal or vertical position, as numbers 1, 2, and 3; *a b* is a bar fixed to the end of the pipe at *a*, and connected by a moveable joint at *b*, to one end of a lever *b c d*: this lever moves upon a fixed centre at *c*; at *d* is another moveable joint from which proceed *d e*, or bar or rod, with a valve *e* at its extremity; this valve when shut, fits into a seat at *f*; *g h i* is a valve box fastened to the end of the pipe A, and having a stuffing box at *h*, for the rod *d e* to work through, and an opening or branch at *i*, to take away the air, or air and condensed steam, after it has passed the valve. The apparatus being arranged as described and shewn in the figure, on admitting steam into the pipe, the end A will be expanded towards C; this will cause the bar *a b* to act upon, and move the lever *b c d* in such a manner, that by its connection with the valve *e*, this valve will be made to approach the seat *f*, while the said valve seat *f* is approaching the valve, and by this means the valve may be made to shut, when the pipe A is either partly or wholly

heated

heated, there being an adjusting screw at *a*, to regulate the length of the bar *a b*, and thereby cause the valve to shut sooner or later, according to the degree of heat required in the place to be warmed.

Thirdly, another method of applying the expansive force aforesaid, to regulate the discharge of air, or air and condensed steam, as shewn in Fig. 3, and which can be applied to pipes placed in an horizontal, vertical, or other position. A represents one end of a steam-pipe, (of which the other end is fixed as described in Fig. 1), *a b*, a tube fixed to the pipe and communicating with it, the end *b* forms a seat for the valve *c*, and this valve is fixed in a box *d, e, f,* fixed in the position shewn, and furnished with a stuffing box at *d*, in which the tube *a b* is contained; the branch or opening *f*, is to convey the air, or air and condensed steam, after it is discharged through the tube *a b*; at *g* is an adjusting screw by which the position of the valve, with respect to its distance from the seat *b*, can be regulated. The parts being arranged as shewn, the valve will be closed by the expansion of the pipe A, on admitting steam therein, and the regular discharge of the air, or air and condensed steam, will be effected by the apparatus just described, that is in Fig. 3, and also by the apparatus in Fig 2, in the same manner as described in Fig. 1. The method shewn in Fig. 3, is particularly applicable in cases where the steam-pipe A is of considerable length, and its quantity of expansion therefore considerable; but by enlarging the diameter of the tube and valve, it may be applied where the steam-pipe is comparatively short.

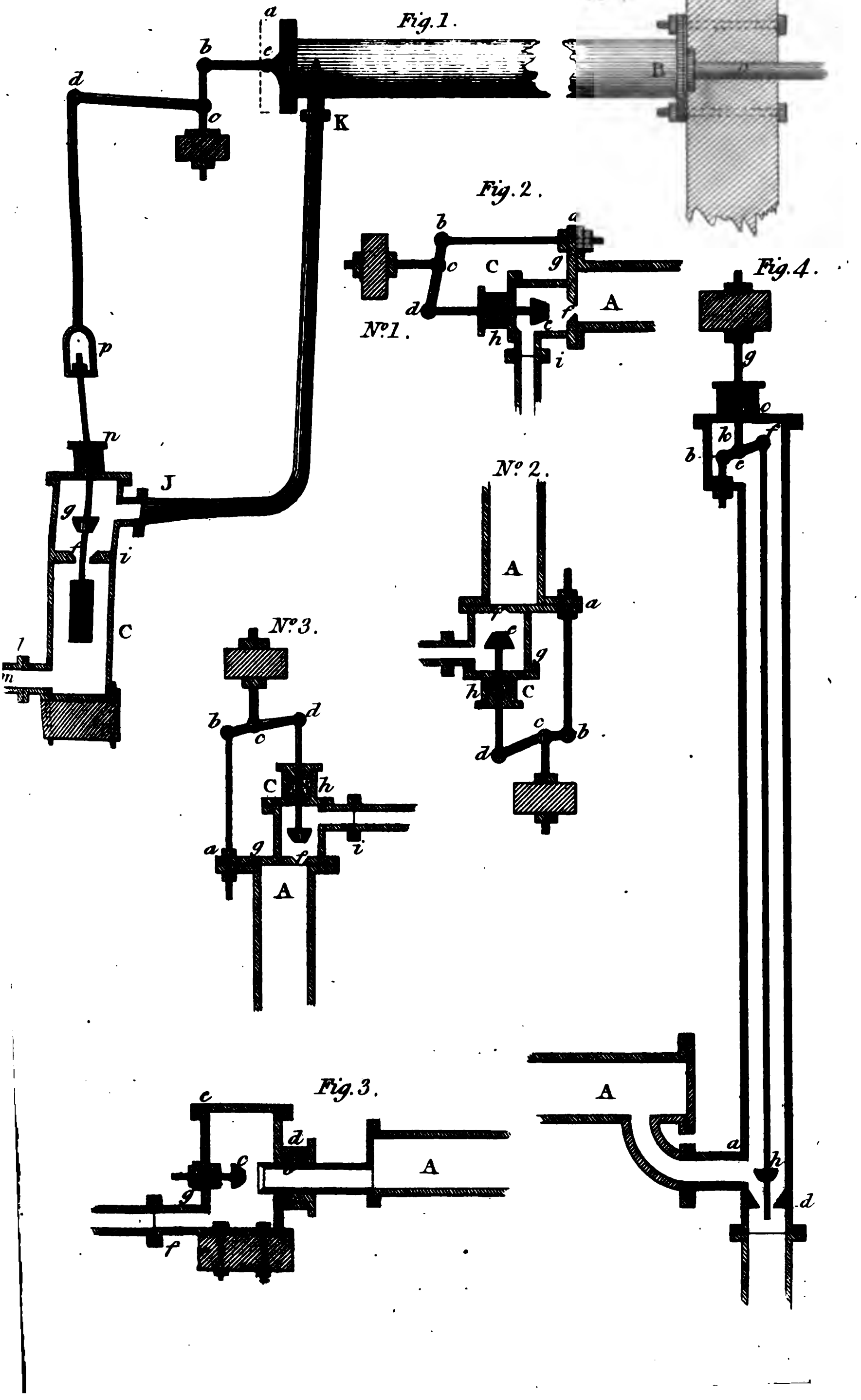
Fourthly, the said expansive force may be applied to regulate the aforesaid discharge from a steam-pipe A, Fig. 4, by causing the steam to act upon and expand an apparatus connected with the pipe A; *a, b, c, d,* is a tube

or

or vessel of copper or other metal, capable of expanding considerably by heat, and it is formed to the pipe A, by a branch *a;* at *b* is a joint connected with the upper part of the tube; *c* is a stuffing box; *d*, an opening in which is fixed a valve seat, through which the air, or air and condensed steam, is discharged *g*; *e*, a rod or bar fixed at *g*, passing through the stuffing C, and its lower end *e* carries the fixed axis upon which the lever *k, e, f,* moves; the end *k*, is connected with the pivot at *b*, and the end *f*, with a bar or rod (of copper or other metal, capable of expanding considerably by heat) *f h*, to the lower end of which is fixed a valve, and this valve when shut fits the seat *d;* steam being admitted into A, and through the branch *a*, into the vessel *a b c d*, this vessel will expand in length, and the pivot *b*, acting upwards upon the end *k* of the lever *k, e, f*, will cause its other end *f* to be depressed, and will have a tendency to close to the valve at *h*, and this tendency will be increased by the expansion of the bar *f*, *h;* the different parts of this apparatus being properly adjusted, the valve *h* will be shut, when the whole of it (that is the apparatus) is heated, and any escape of air, or air and condensed steam, prevented, until an accumulation of these in the apparatus shall have cooled it a little, and thereby cause the parts to contract, by which the valve will again be opened, and the air, or air and condensed steam, again be discharged, and this discharge will proceed with regularity in the same manner as pointed out by Fig. 1. I have thus described different methods by which the aforesaid force obtained, by the expansion and contraction of the pipes conveying steam, or by that of other pipes or bars attached to them, may be applied, to the effecting and regulating the discharge of air, or air and condensed steam; but my invention consists in the application of these

forces

Mr. Houldsworth's Patent.



forces to effect and regulate such discharge. The methods by which the force aforesaid can be applied to the purpose above specified are various. Those which I have described are what I generally adopt, and will readily suggest other methods of applying the aforesaid force to the purpose above specified.

In witness whereof, &c.

Specification of the Patent granted to WILLIAM BENECKE, *of Deptford, in the County of Kent, Gentleman; for an improved Method of manufacturing Verdigris, of the same Quality as that known in Commerce by the Name of French Verdigris.*

Dated November 12, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Benecke do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say: First, Verdigris can be produced only by acetic acid, or all substances that contain it in a free or even incipient state. Secondly, the strongest kinds of acid appear to me the best adapted for the manufacture. In this I include all vinegars or liquids containing the acetic acid, made from sugar, malt, grain, wood, or other vegetables. Thirdly, vinegar, or the fluids containing the acetic acid, can produce verdigris only when applied in the state of vapour to copper; but in this state it will have the desired effect, whether it be by sponges, woollen, cotton, linen, or hair-cloth, in fact by all substances that can retain the acetic fluid. Fourthly, the particular art in

making verdigris is to contrive, that the vapour may be disengaged from the substances containing the acetic acid, that a sufficient and not too great access be given to the air, and that the vapours may be allowed to attach themselves to the surface of the copper, which is done by moderating the pressure, by interposing hard substances between the stratified copper and the containing substance, without allowing the vapours, which are essential in the formation of verdigris, to escape. My procedure is as follows: *viz.* I lay copper-plates alternately with woollen, cotton, linen, felt, or hair-cloth, or any other substance capable of holding acid, giving, however, the preference to a substantial well shorn woollen cloth, which cloth or stuff is wetted before with acetic acid, made in any way by fermentation, distillation, decomposition, &c.; every real acetic acid will answer the purpose, though I give the preference to distilled and highly purified acid: between each stratification some small pieces of wood or other hard substance are put to prevent too much pressure, to give access to the air, and to bring the vapours of acid into contact with the copper, so that a combined operation of the acid (which now attaches itself as it were in a distilled state to the copper) and of the oxygen of the atmospheric air takes place. In this state I let it remain undisturbed for some time until an efflorescence of verdigris has taken place, which efflorescence appears and ripens sooner or later, according to the place where the sheets are kept, and to the temperature and co-operation of the atmosphere. The verdigris is then either scraped off or fed before this operation, by sprinkling the plates or dipping them in water or other fluids, as wine, diluted acid, &c. The verdigris is then cleaned as accurately as possible from all foreign substances, and prepared in the usual way for the market; the

the verdigris thus obtained will be at great perfection, The cloth and the copper-plates are used in the same manner as before described, till they are worn out.

In witness whereof, &c.

Description of a Bolt to be used instead of one mentioned in a preceding Number of this Work.

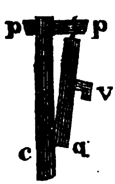
By Mr. L. Gompertz, *of Kennington Oval, Surrey.*

Communicated in a Letter to the Editors.

Gentlemen,

I AM desirous of informing the publick, that I have contrived a bolt to be used in the room of the one explained in my Specification of "Sundry Improvements in Carriages," &c. inserted in vol. XXVI. p. 201, and Figs. 6 and 7, Plate VII. of the Repertory, which I think far superior to the method described, and is as follows.

Instead of letting the bolts *p q* work backwards and forwards parallel to the slider *c*, let the said bolt *p q* turn on a joint or hinge at *q*. Let the parts of the bolts *pp* and *pq* be in two separate pieces; and let *pp* have a hole in it parallel to the slider *c*, through which the end of *pq* is to work in moving the part *pp* backwards and forwards. *v* is the hook removed to the middle of *p q*, instead of being at *q*. By this plan the bolts will work more freely, and will not require such nice workmanship as by the former method.



N. B. Your readers are requested to observe that in vol. XXVI. page 2, line 33, *for* 69 *read* 60.

Yours, &c.

June 4, 1815. L. Gompertz.

On Agricultural Chemistry.

Extracted from Sir HUMPHRY DAVY's Lectures.

Of Manures of vegetable and animal Origin. Of the Manner in which they become the Nourishment of the Plant. Of Fermentation and Putrefaction. Of the different Species of Manures of vegetable Origin; of the different Species of animal Origin. Of mixed Manures. General Principles with respect to the Use and Application of such Manures.

(Concluded from Page 32.)

BONES are much used as a manure in the neighbourhood of London. After being broken, and boiled for grease, they are sold to the farmer. The more divided they are the more powerful are their effects. The expense of grinding them in a mill would probably be repaid by the increase of their fertilising powers; and in the state of powder they might be used in the drill husbandry, and delivered with the seed, in the same manner as rape cake.

Bone dust, and bone shavings, the refuse of the turning manufacture, may be advantageously employed in the same way.

The basis of bone is constituted by earthy salts, principally phosphate of lime, with some carbonate of lime and phosphate of magnesia; the easily decomposable substances in bone are fat, gelatine, and cartilage, which seem of the same nature as coagulated albumen.

According to the analysis of Fourcroy and Vauquelin, ox bones are composed

Of

Of decomposable animal matter	51
— phosphate of lime	37.7
— carbonate of lime	10
— phosphate of magnesia	1.3
	100

M. Merat Guillot has given the following estimate of the composition of the bones of different animals.

	Phosphate of Lime.	Carbonate of Lime.
Bone of calf	54	
—— horse	67.5	1.25
—— sheep	70	5
—— elk	90	1
—— hog	52	1
—— hare	85	1
—— pullet	72	1.5
—— pike	64	1
—— carp	45	5
Horses teeth	85.5	20.5
Ivory	64	1

The remaining parts of the 100 must be considered as decomposable animal matter.

Horn is a still more powerful manure than bone; as it contains a larger quantity of decomposable animal matter. From 500 grains of ox-horn Mr. Hatchett obtained only 1.5 grains of earthy residuum, and not quite half of this was phosphate of lime. The shavings or turnings of horn form an excellent manure, though they are not sufficiently abundant to be in common use. The animal matter in them seems to be of the nature of coagulated albumen, and it is slowly rendered soluble by the action of water. The earthy matter in horn, and still more that in bones, prevents the too rapid decomposition

position of the animal matter, and renders it very durable in its effects.

Hair, woollen rags, and *feathers,* are all analogous in composition, and principally consist of a substance similar to albumen, united to gelatine. This is shewn by the ingenious researches of Mr. Hatchett. The theory of their operation is similar to that of bone and horn shavings.

The *refuse* of the different manufactures of *skin* and *leather* form very useful manures; such as the shavings of the currier, furriers' clippings, and the offals of the tan-yard, and of the glue-maker. The gelatine contained in every kind of skin is in a state fitted for its gradual solution or decomposition; and when buried in the soil it lasts for a considerable time, and constantly affords a supply of nutritive matter to the plants in its neighbourhood.

Blood contains certain quantities of all the principles found in other animal substances, and is consequently a very good manure. It has been already stated that it contains fibrine; it likewise contains albumen: the red particles in it, which have been supposed by many foreign chemists to be coloured by iron in a particular state of combination with oxygen and acid matter, Mr. Brande considers as formed of a peculiar animal substance, containing very little iron.

The scum taken from the boilers of the sugar-bakers, and which is used as a manure, principally consists of bullocks blood, which has been employed for the purpose of separating the impurities of common brown sugar, by means of the coagulation of its albuminous matter by the heat of the boiler.

The different species of *corals, cordlines,* and *sponges,* must be considered as substances of animal origin. From the

the analysis of Mr. Hatchett, it appears that all these substances contain considerable quantities of a matter analogous to coagulated albumen; the sponges afford likewise gelatine.

According to Merat Guillot, white coral contains equal parts of animal matter and carbonate of lime; red coral 46.5 of animal matter, and 53.5 of carbonate of lime; articulated coraline 51 of animal matter and 49 of carbonate of lime.

These substances are, I believe, never used as manure in this country, except in cases when they are accidentally mixed with sea-weed; but it is probably that the coralines might be advantageously employed, as they are found in considerable quantity on the rocks, and bottoms of the rocky pools on many parts of our coast, where the land gradually declines towards the sea; and they might be detached by hoes, and collected without much trouble.

Amongst excrementations, animal substances used as manures, *urine* is the one upon which the greatest number of chemical experiments have been made, and the nature of which is best understood.

The urine of the cow contains, according to the experiments of Mr. Brande,

Water	65
Phosphate of lime	3
Muriates of potassa and ammonia	15
Sulphate of potassa	6
Carbonates, potassa, and ammonia	4
Urea	4

The urine of the horse, according to Fourcroy and Vauquelin, contains,

Of carbonate of lime	11
— carbonate of soda	9

Of

Of benzoate of soda	24
— muriate of potassa	9
— urea	7
— water and mucilage	940

In addition to these substances, Mr. Brande found in it phosphate of lime.

The urine of the ass, the camel, the rabbit, and domestic fowls, have been submitted to different experiments, and their constitution have been found similar. In the urine of the rabbit, in addition to most of the ingredients above-mentioned, Vauquelin detected gelatine; and the same chemist discovered uric acid in the urine of domestic fowls.

Human urine contains a greater variety of constituents than any other species examined.

Urea, uric acid, and another acid similar to it in nature called rosacic acid, acetic acid, albumen, gelatine, a resinous matter, and various salts, are found in it.

The human urine differs in composition according to the state of the body, and the nature of the food and drink made use of. In many cases of disease there is a much larger quantity of gelatine and albumen than usual in the urine; and in diabetes it contains sugar.

It is probable that the urine of the same animal must likewise differ according to the different nature of the food and drink used; and this will account for discordances in some of the analyses that have been published on the subject.

Urine is very liable to change and to undergo the putrefactive process; and that of carnivorous animals more rapidly than that of graminivorous animals. In proportion as there is more gelatine and albumen in urine, so in proportion does it putrefy more quickly.

The species of urine that contain most albumen, gelatine,

tine, and urea, are the best as manures; and all urine contains the essential elements of vegetables in a state of solution.

During the putrefaction of urine the greatest part of the soluble animal matter that it contains is destroyed; it should consequently be used as fresh as possible; but if not mixed with solid matter, it should be diluted with water, as when pure it contains too large a quantity of animal matter to form a proper fluid nourishment for absorption by the roots of plants.

Putrid urine abounds in ammoniacal salts; and though less active than fresh urine, is a very powerful manure.

According to a recent analysis published by Berzelius, 1000 parts of urine are composed of

Water	933
Urea	30.1
Uric acid	1
Muriate of ammonia, free lactic acid, lactate of ammonia and animal matter	17.14

The remainder different salts, phosphates, sulphates, and muriates.

Amongst excrementitious solid substances used as manures, one of the most powerful is the *dung of birds* that feed on *animal food*, particularly the dung of sea birds. The *guano*, which is used to a great extent in South America, and which is the manure that fertilizes the sterile plains of Peru, is a production of this kind. It exists abundantly, as we are informed by M. Humboldt, on the small islands in the South Sea, at Chinche, Ilo, Iza, and Arica. 50 vessels are laden with it annually at Chinche, each of which carries from 1500 to 2000 cubical feet. It is used as a manure only in very small quantities; and particularly for crops of maize. I made

some experiments on specimens of guano sent from South America to the Board of Agriculture in 1805. It appeared as a fine brown powder; it blackened by heat, and gave off strong ammoniacal fumes; treated with nitric acid it afforded uric acid. In 1806 M. M. Fourcroy and Vauquelin published an elaborate analysis of guano. They state that it contains a fourth part of its weight of uric acid, partly saturated with ammonia, and partly with potassa; some phosphoric acid combined with the bases, and likewise with lime. Small quantities of sulphate and muriate of potassa, a little fatty matter, and some quartzose sand.

It is easy to explain its fertilizing properties: from its composition it might be supposed to be a very powerful manure. It requires water for the solution of its soluble matter to enable it to produce its full beneficial effect on crops.

The dung of sea birds has, I believe, never been used as a manure in this country; but it is probable, that even the soil of the small islands on our coast much frequented by them, would fertilize. Some dung of sea birds brought from a rock on the coast of Merionethshire, produced a powerful but transient effect on grass. It was tried, at my request, by Sir Robert Vaughan at Nannau.

The rains in our climate must tend very much to injure this species of manure, where it is exposed to them, soon after its deposition; but it may probably be found in great perfection in caverns or clefts in rocks, haunted by cormorants and gulls. I examined some recent cormorant's dung which I found on a rock near Cape Lizard in Cornwall. It had not at all the appearance of the guano; was of a grayish white colour; had a very fœtid smell like that of putrid animal matter: when acted on

by

by quick-lime it gave abundance of ammonia; treated with nitric acid it yielded uric acid.

Night soil, it is well known, is a very powerful manure, and very liable to decompose. It differs in composition; but always abounds in substances composed of carbon, hydrogen, azote, and oxygen. From the analysis of Berzelius, it appears that a part of it is always soluble in water; and in whatever state it is used, whether recent or fermented, it supplies abundance of food to plants.

The disagreeable smell of night soil may be destroyed by mixing it with quicklime; and if exposed to the atmosphere in thin layers strewed over with quicklime in fine weather, it speedily dries, is easily pulverised, and in this state may be used in the same manner as rape cake, and delivered into the furrow with the seed.

The Chinese, who have more practical knowledge of the use and application of manures than any other people existing, mix their night soil with one-third of its weight of a fat marle, make it into cakes, and dry it by exposure to the sun. These cakes, we are informed by the French missionaries, have no disagreeable smell, and form a common article of commerce of the empire.

The earth, by its absorbent powers, probably prevents, to a certain extent, the action of moisture upon the dung, and likewise defends it from the effects of air.

After night soil, *pigeons' dung* comes next in order, as to fertilizing power. I digested 100 grains of pigeons' dung, in hot water for some hours, and obtained from it 23 grains of soluble matter; which afforded abundance of carbonate of ammonia by distillation; and left carbonaceous matter, saline matter, principally common salt, and carbonate of lime as a residuum. Pigeon's dung when moist readily ferments, and after fermentation contains

tains less soluble matter than before: from 100 parts of fermented pigeons' dung, I obtained only eight parts of soluble matter, which gave proportionally less carbonate of ammonia in distillation than recent pigeons' dung.

It is evident that this manure should be applied as new as possible; and when dry, it may be employed in the same manner as the other manures capable of being pulverised.

The soil in woods where great flocks of wood-pigeons roost, is often highly impregnated with their dung, and it cannot be doubted, would form a valuable manure. I have found such soil yield ammonia when distilled with lime. In the winter likewise it usually contains abundance of vegetable matter, the remains of decayed leaves; and the dung tends to bring the vegetable matter into a state of solution.

The dung of *domestic fowls* approaches very nearly in its nature to pigeons' dung. Uric acid has been found in it. It gives carbonate of ammonia by distillation, and immediately yields soluble matter to water. It is very liable to ferment.

The dung of fowls is employed in common with that of pigeons by tanners to bring on a slight degree of putrefaction in skins that are to be used for making soft leather; for this purpose the dung is diffused through water. In this state it rapidly undergoes putrefaction, and brings on a similar change in the skin. The excrement of dogs are employed by the tanner with similar effects. In all cases, the contents of the *grainer*, as the pit is called in which soft skins are prepared by dung, must form a very useful manure.

Rabbits' dung has never been analysed. It is used with great success as a manure by Mr. Fane, who finds it profitable to keep rabbits in such a manner as to preserve their

their dung. It is laid on as fresh as possible, and is found better the less it has fermented.

The *dung* of *cattle*, *oxen*, and *cows*, has been chemically examined by M. M. Einhof and Thaer. They found that it contained matter soluble in water; and that it gave in fermentation nearly the same products as vegetable substances, absorbing oxygen and producing carbonic acid gas.

The recent *dung* of *sheep*, and of *deer*, afford, when long boiled in water, soluble matters, which equal from two to three *per cent.* of their weight. I have examined these soluble substances procured by solution and evaporation; they contain a very small quantity of matter analogous to animal mucus; and are principally composed of a bitter extract, soluble both in water and in alcohol. They give ammoniacal fumes by distillation; and appear to differ very little in composition.

I watered some blades of grass for several successive days with a solution of these extracts; they evidently became greener in consequence, and grew more vigorously than grass in other respects, under the same circumstances.

The part of the dung of cattle, sheep, and deer, not soluble in water, appears to be mere woody fibre, and precisely analogous to the residuum of those vegetables that form their food after they have been deprived of all their soluble materials.

The dung of horses gives a brown fluid, which when evaporated, yields a bitter extract, which affords ammoniacal fumes more copiously than that from the dung of oxen.

If the pure dung of cattle is to be used as manure, like the other species of dung which have been mentioned, there seems no reason why it should be made to ferment

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except in the soil; or if suffered to ferment, it should be only in a very slight degree. The grass in the neighbourhood of recently voided dung, is always coarse and dark green; some persons have attributed this to a noxious quality in unfermenting dung; but it seems to be rather the result of an excess of food furnished to the plants.

The question of the proper mode of the application of the dung of horses and cattle, however, properly belongs to the subject of *composite manures*, for it is usually mixed in the farm-yard with straw, offal, chaff, and various kind of litter; and itself contains a large proportion of fibrous vegetable matter.

A slight incipient fermentation is undoubtedly of use in the dunghill; for by means of it a disposition is brought on in the woody fibre to decay and dissolve, when it is carried to the land, or ploughed into the soil; and woody fibre is always in great excess in the refuse of the farm.

Too great a degree of fermentation is, however, very prejudicial to the composite manure in the dunghill; it is better that there should be no fermentation at all before the manure is used, than that it should be carried too far. This must be obvious from what has been already stated in this Lecture. The excess of fermentation tends to the destruction and dissipation of the most useful part of the manure; and the ultimate results of this process are like those of combustion.

It is a common practice amongst farmers to suffer the farm-yard dung to ferment till the fibrous texture of the vegetable matter is entirely broken down; and till the manure becomes perfectly cold, and so soft as to be easily cut by the spade.

Independent of the general theoretical views unfavourable

able to this practice, founded upon the nature and composition of vegetable substances, there are many arguments and facts which shew that it is prejudicial to the interests of the farmer.

During the violent fermentation which is necessary for reducing farm-yard manure to the state in which it is called *short muck*, not only a large quantity of fluid, but likewise of gaseous matter, is lost; so much so, that the dung is reduced one half, or two-thirds in weight; and the principal elastic matter disengaged, is carbonic acid with some ammonia; and both these, if retained by the moisture in the soil, as has been stated before, are capable of becoming an useful nourishment of plants.

In October, 1808, I filled a large retort capable of containing three pints of water, with some hot fermenting manure, consisting principally of the litter and dung of cattle; I adapted a small receiver to the retort, and connected the whole with a mercurial pneumatic apparatus, so as to collect the condensible and elastic fluids which might rise from the dung. The receiver soon became lined with dew, and drops began in a few hours to trickle down the sides of it. Elastic fluid likewise was generated; in three days thirty-five cubical inches had been formed, which, when analyzed, were found to contain twenty-one cubical inches of carbonic acid, the remainder was hydrocarbonate mixed with some azote, probably no more than existed in the common air in the receiver. The fluid matter collected in the receiver at the same time amounted to nearly half an ounce. It had a saline taste, and a disagreeable smell, and contained some acetate and carbonate of ammonia.

Finding such products given off from fermenting litter, I introduced the beak of another retort filled with similar dung very hot at the time, in the soil amongst the roots of

of some grass in the border of a garden; in less than a week a very distinct effect was produced on the grass; upon the spot exposed to the influence of the matter disengaged in fermentation, it grew with much more luxuriance than the grass in any other part of the garden.

Besides the dissipation of gaseous matter when fermentation is pushed to the extreme, there is another disadvantage in the loss of *heat*, which, if excited in the soil, is useful in promoting the germination of the seed, and in assisting the plant in the first stage of its growth, when it is most feeble and most liable to disease: and the fermentation of manure in the soil must be particularly favourable to the wheat crop in preserving a genial temperature beneath the surface late in autumn, and during winter.

Again, it is a general principle in chemistry, that in all cases of decomposition, substances combine much more readily at the moment of their disengagement, than after they have been perfectly formed. And in fermentation beneath the soil the fluid matter produced is applied instantly, even whilst it is warm, to the organs of the plant, and consequently is more likely to be efficient, than in manure that has gone through the process; and of which all the principles have entered into new combinations.

In the writings of scientific agriculturists, a great mass of facts may be found in favour of the application of farm-yard dung in a recent state. Mr. Young, in the Essay on Manures, which I have already quoted, adduces a number of excellent authorities in support of the plan. Many, who doubted, have been lately convinced; and perhaps there is no subject of investigation in which there is such a union of theoretical and practical evidence. I have myself, within the last ten years, witnessed

nessed a number of distinct proofs on the subject. I shall content myself with quoting that which ought to have, and which I am sure will have, the greatest weight amongst agriculturists. Within the last seven years Mr. Coke has entirely given up the system formerly adopted on his farm, of applying fermented dung; and he informs me, that his crops have been since as good as they ever were, and that his manure goes nearly twice as far.

A great objection against slightly fermented dung is, that weeds spring up more luxuriantly where it is applied. If there are seeds carried out in the dung they certainly will germinate; but it is seldom that this can be the case to any extent; and if the land is not cleansed of weeds, any kind of manure fermented or unfermented will occasion their rapid growth. If slightly fermented farm-yard dung is used as a top dressing for pastures, the long straws and unfermented vegetable matter remaining on the surface should be removed as soon as the grass begins to rise vigorously, by raking, and carried back to the dunghill: in this case no manure will be lost, and the husbandry will be at once clean and œconomical.

In cases when farm-yard dung cannot be immediately applied to crops, the destructive fermentation of it should be prevented as much as possible: the principles on which this may be effected have been already alluded to.

The surface should be defended as much as possible from the oxygen of the atmosphere; a compact marle, or a tenacious clay, offers the best protection against the air; and before the dung is covered over, or, as it were, sealed up, it should be dried as much as possible. If the dung is found at any time to heat strongly, it should be turned over, and cooled by exposure to air.

Watering dunghills is sometimes recommended for checking the progress of fermentation; but this practice

is inconsistent with just chemical views. It may cool the dung for a short time; but moisture, as I have before stated, is a principal agent in all processes of decomposition. Dry fibrous matter will never ferment. Water is as necessary as air to the process; and to supply it to fermenting dung, is to supply an agent which will hasten its decay.

In all cases when dung is fermenting, there are simple tests by which the rapidity of the process, and consequently the injury done, may be discovered.

If a thermometer plunged into the dung does not rise to above 100 degrees of Fahrenheit, there is little danger of much aeriform matter flying off. If the temperature is higher, the dung should be immediately spread abroad.

When a piece of paper moistened in muriatic acid held over the steams arising from a dunghill gives dense fumes, it is a certain test that the decomposition is going too far, for this indicates that volatile alkali is disengaged.

When dung is to be preserved for any time, the situation in which it is kept is of importance. It should, if possible, be defended from the sun. To preserve it under sheds would be of great use; or to make the site of a dunghill on the north side of a wall. The floor on which the dung is heaped, should, if possible, be paved with flat stones; and there should be a little inclination from each side towards the centre, in which there should be drains connected with a small well, furnished with a pump, by which any fluid matter may be collected for the use of the land. It too often happens that a dense mucilaginous and extractive fluid is suffered to drain away from the dunghill, so as to be entirely lost to the farm.

Street and *road dung*, and the *sweepings of houses*, may be all regarded as composite manures; the constitution

of

of them is necessarily various, as they are derived from a number of different substances. These manures are usually applied in a proper manner, without being fermented.

Soot, which is principally formed from the combustion of pit-coal, or coal, generally contains likewise substances derived from animal matters. This is a very powerful manure. It affords ammoniacal salts by distillation, and yields a brown extract to hot water, of a bitter taste. It likewise contains an empyreumatic oil. Its great basis is charcoal, in a state in which it is capable of being rendered soluble by the action of oxygen and water.

This manure is well fitted to be used in the dry state, thrown into the ground with the seed, and requires no preparation.

The doctrine of the proper application of manures from organised substances, offers an illustration of an important part of the œconomy of nature, and of the happy order in which it is arranged.

The death and decay of animal substances tend to resolve organised forms into chemical constituents; and the pernicious effluvia disengaged in the process seem to point out the propriety of burying them in the soil, where they are fitted to become the food of vegetables. The fermentation and putrefaction of organised substances in the free atmosphere are noxious processes; beneath the surface of the ground they are salutary operations. In this case the food of plants is prepared where it can be used; and that which would offend the senses and injure the health, if exposed, is converted by gradual processes into forms of beauty and of usefulness; the fœtid gas is rendered a constituent of the aroma of the flower, and what might be poison, becomes nourishment to animals and to man.

On an easier Mode of procuring Potassium than that which is now adopted.

By SMITHSON TENNANT, *Esq. F. R. S.*

With a Wood Engraving.

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

THE great discovery of Sir H. Davy, that the alkalies might be decomposed by the voltaic electricity, was soon succeeded by that of Gay Lussac and Thenard, who shewed that a similar decomposition of them might be produced by means of iron.

Besides the new and unexpected fact which was thus brought to light, that the alkaline metals might be deprived of oxygen by a substance inferior to them in attraction; this new process was highly valuable, in affording the means of obtaining them far more abundantly than by electricity.

The circumstances described by Gay Lussac and Thenard, as requisite for producing the decomposition of the alkalies by iron, are, first, that the iron should be intensely heated, and afterwards that the alkalies should be brought in contact with it in that heated state. For this purpose a furnace must be made, capable of admitting a gun barrel, containing the iron turnings, to pass through it, and a short piece of barrel containing the alkali must be adapted to the former by grinding, so as to be air tight. As this short piece of barrel is out of the furnace, G. Lussac and Thenard direct that a separate fire be applied to it, in order to make the alkali pass from it into the longer barrel. To avoid the necessity of a separate fire, this passage of the alkali has, in England, been generally effected through a small perforation between the two

two barrels, being poured very hot into the smaller barrel, which is then closed with a ground stopper.

The process conducted in either way requires the construction of a particular furnace, and the correct fitting of the barrels by grinding, so as to be air tight, and being somewhat complicated is not always performed with success.

As it was very desirable to facilitate the mode of obtaining potassium, which is so powerful a chemical agent, I have attempted to simplify the process, and having so far succeeded as to render it capable of being performed in a common smith's fire, and without the junction of the iron barrels by grinding, I have thought it might deserve to be communicated to the Royal Society.

If it was absolutely necessary to heat the alkali and iron separately, and in that state to unite them, no material improvement in the simplicity of the present apparatus could be reasonably looked for; but upon considering that the alkali frequently passed through the short barrel in a few minutes, it did not seem probable that much of the potassium was then formed, since the whole operation required a continuance of the heat for near an hour.

In order therefore to learn whether potassium might not be produced merely by distilling turnings of iron and potash, I put the two together into a piece of gun barrel, the lower end of which was closed by welding, and the upper end by a cork, having a small glass tube through it to admit the escape of air.

The lower end of the barrel being coated as usual with lute to protect it from the air, was exposed to a strong heat, whilst the upper part was kept cool; and upon opening the barrel, when it had become quite cold, it was found that potassium had sublimed into the upper part.

part. The potassium, however, so produced, though it burnt on contact with water, had not the purely metallic aspect of that formed in the common mode. It was of a more dusky appearance, resembling a mixture of some black powder with potassium. As it seemed probable that some of the potash had risen along with the potassium, I repeated the experiment with attention, to heat the barrel to a greater length, so as to force the potassium to rise further from the ingredients below, but the potassium formed with this precaution had nearly the same dusky appearance as before.

After trying different means for obviating this imperfection, I found the following to be quite effectual. Into the upper part of the barrel a narrower piece, nearly fitting it, was inserted, open only by a perforation at the lower end to admit the vapour of the potassium to pass into it, and upon distilling potash and iron turnings with this addition, the potassium rose into the narrow tube, quite pure, with its usual brightness.

The most convenient dimensions of the apparatus, are for the external barrel to be about a foot and a half long, and the internal one about seven or eight inches. The latter should not be wholly inserted in the former, but about an inch of it left out for the greater ease in withdrawing it. The width is in general determined by that of a common gun barrel, but may be increased to a certain degree. I have had the thick part of a gun barrel so much enlarged by hammering it thinner, as to contain twice as much iron turnings and potash, and have employed it with success. But on the other hand, there are limits to this extension of the width, arising from the increased difficulty of making the heat penetrate throughout.

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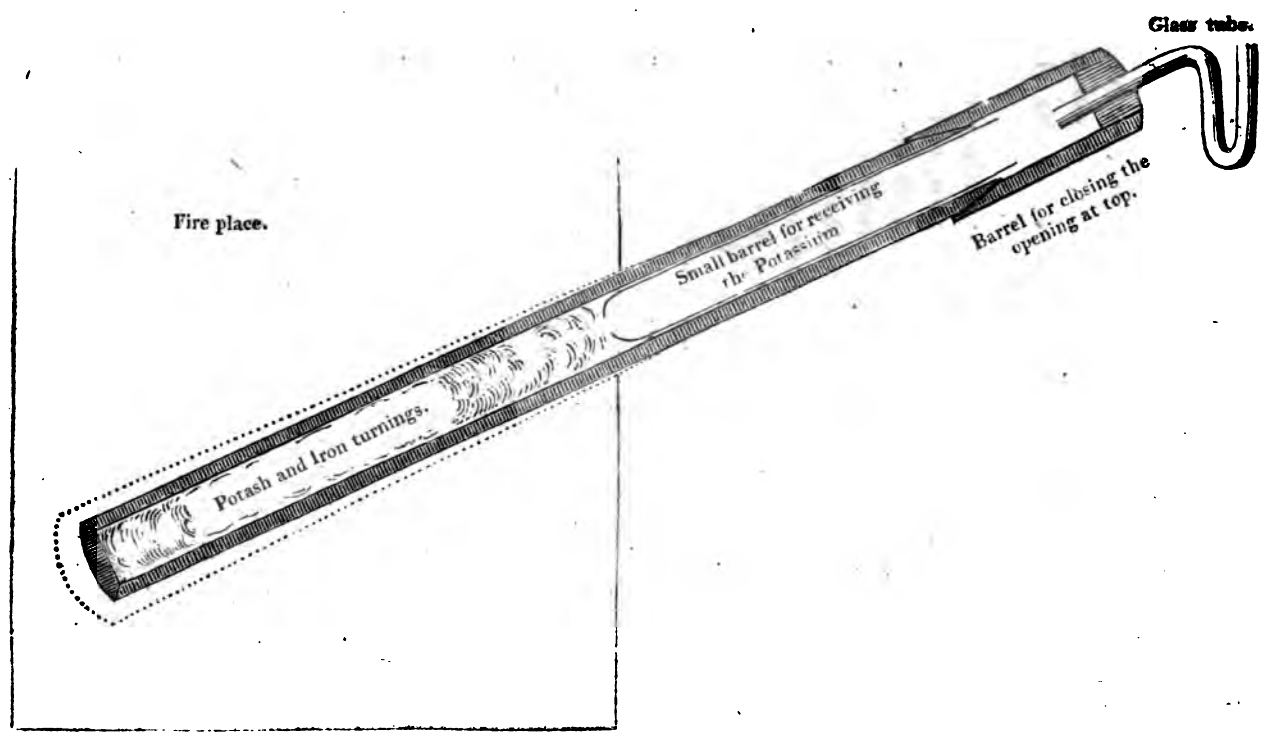
Glass tube.
Fire place.
Small barrel for receiving the Potassium
Barrel for closing the opening at top.
Potash and Iron turnings.

The opening of the barrels at the top must be covered with a cap or wide tube, which being at a distance from the fire need only be fastened with sealing wax, but for the greater security of keeping this part cool, the whole of the tube which is out of the fire should be wrapped round with linen or blotting paper kept wet.

The opening of the wide tube must be closed with a cork having a crooked tube of glass through it, containing a drop of mercury, which being moved by the passage of the air shews that the vessels are perfectly tight. But the annexed sketch will at once shew both the construction and dimensions of the apparatus.

The principal point to be attended to, both in this and in the common mode, is the giving a strong heat, which should be continued for the greater part of an hour; and to enable the iron barrel to support this, it is quite essential to cover it with a proper lute, carefully applied.

The lute which I have found most effectual for this purpose was composed of a small proportion of Stourbridge clay in its natural state, with a much larger proportion which had before been burnt and powdered, and both of which may be easily had at any glass house.

Observations on the Superiority of Composts to simple Dungs. By Mr. David Weighton, *Gardener to the Earl of Leven and Melville, Melville House, Fife.*

From the Transactions of the Caledonian Horticultural Society.

THE first thing to be done in gardening, is to consider where to get materials for making compost; and as this compost is to be adapted for the improvement of the soil which the gardener is to work upon, it ought to be mixed according as it is either for light sandy, or heavy

soil. It is evident, that light land must require a compost of a heavy nature, such as the scourings of ditches or ponds, and clay; and no less so, that the other kinds of land require a compost of a light or fiery nature, such as will divide its heavy and adhering particles.

The following forms a good compost for cold clayey land:

Three load of light mould; one load of rotten dung; one load of sharp sand; one load of coal-ashes; half a load of lime, with a quantity of pigeon, sheep, or other hot dungs.

And the following is a suitable compost for light sandy ground:

Two load of the natural soil; three load of pond earth, or the scourings of ditches; three load of strong loamy earth; one load of clay; two load of dung, and one load of marl, if to be found.

In both cases let them all be well mixed together, and thrown up in a large heap, and turned over once or twice before being used.

It is my opinion that all dung should be laid up in this manner. Indeed, the common way of spreading dung over land, be it either arable or pasture, can by no means answer the end; for the fertilizing particles of dung being of a volatile nature, are readily exhausted by the action of the sun and air.

I have always observed, that there is no land so soon worn out as light sandy ground. Though clay land be much more intractable than this, yet being of a heavier texture, the fertilizing particles seem to remain longer in action than in a more sandy ground. For this reason, clay-land is by some preferred, especially if dug or rather trenched every year, and laid up in ridges all winter to meliorate.

 I shall

I shall now state the manner of using the compost so prepared. A trench being opened in the borders or ground, where it is to be used, and the compost lying at hand, fill the bottom of the trench eight inches deep with it; then take up the whole ground in the next trench ten inches deep, and spread it over the compost that is laid at the bottom of the trench. Which done, cover that bad or indifferent earth over again with the same thickness of compost; by which means, you have three strata, two of compost, with the indifferent earth in the middle. And this being done at the latter part of the year, let it remain till the spring; at which time, dig the ground over, mixing the compost and the old mould together; which, by the washing of the rains, and the action of the frosts in the winter, will greatly improve it.

It may perhaps be thought strange that I have not recommended more dung, that being generally esteemed the grand improvement for all lands, and indeed it is what most people are fond of. If they have dung enough all is well, and they think vegetation cannot fail of going on. This is especially the case in the repairing of worn-out grounds. But with this, I can by no means agree. I esteem dung no more than a good ingredient to mix with earth and other sorts of compost. It ought to be well mixed and incorporated with them, and they being all consumed together, make an excellent compost fit for new planted trees, or for repairing worn out ground.

Whether the land worn out, be either heavy or light, the two different composts which I have recommended, will suit them; and for other lands, one of a middle quality may easily be formed.

I have avoided running into sub-divisions of the kinds of soils; since doing so tends rather to mislead than to instruct gardeners in the execution of their business.

A Method

A Method of destroying one Sort of the Gooseberry Caterpillar. By Mr. JOHN TWEEDIE, *Gardener to Mr. Hamilton, Sundrum.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

AMONG the various necessary acquirements which a gardener ought to possess, that of subduing the devouring hordes of insects with which he is continually annoyed, is certainly an important one. There is not a seed thrown from his hand, nor a plant which he puts into the ground, but is liable to be destroyed by insects, reptiles, or vermin of one description or another. Many insects not only feed upon the plants, but constantly lodge about them, and thus produce a great many distempers and failures in the vegetable kingdom, often imputed to other causes. Among gardeners, gooseberry caterpillars have long been complained of: almost every year has produced a new receipt for their destruction: still we find a repetition of the complaint, and another method wanted. Had a complete knowledge of their modes of life, and the seasons of their transformation, been acquired, the destruction of some kinds could readily have been accomplished. There are two distinct kinds, of one of which only I am now to treat.

In the year 1803, I selected a few bushes very much overrun with caterpillars, on purpose to observe the progress of the caterpillars, as also to see what became of them at last; and after strict observation, I found that these caterpillars went into winter quarters precisely under the bushes whereon they were fed, and if any old dung or rotten leaves lay under the branches, or about the roots, they gathered to such in great numbers: these

substances appear indeed, to be the chief material of which their chrysalids are formed.

In the spring following, I put some of these chrysalids into a hot-bed, and confined them, on purpose to obtain a knowledge of the parent fly; and though they had been exposed to the preceding winter frost by their own choice, being only covered at most two inches under the surface, they, with the exception of four out of fifty, produced each a full grown fly. It must of course be admitted, that the inclemency of the weather cannot destroy them in the chrysalis state, as was supposed by many would have been the case.

It may easily be understood, that gooseberry bushes ought not to be planted beside box-edgings, flower-borders, and beds or rows of strawberries, as is often done, all these affording suitable winter retreats to the caterpillars. I immediately removed all my bushes, both currants and gooseberries, into quarters by themselves, and placed them in rows, as the growth of the different sorts required.

I then adopted the following simple method of destruction: In the course of any of the winter months, I pare all the earth from under the bushes to the depth of about three inches, into a flat ridge betwixt the rows; and on the first dry day following, I either tread, beat, or roll these ridges, and trench the whole down one and a half or two spade deep, observing to tread the foul earth into the bottom of the trench.

The natural season of this insect, is from the middle of April to the first of June; between which times, the cold easterly wind is most predominant, which causes the fly to take shelter under the young foliage; hence arises that ancient notion of such insects being brought by the east wind. On the foliage they lose no time in

breeding

breeding and depositing their eggs. I have often seen those vermin so late as July, and even in August; this is probably owing to their having been buried from the sun's influence in the common process of digging, being then deprived of immediate warmth, and so remaining longer in their nymph state.

Observations on the Cultivation of Sea-cale.

By Sir GEORGE STEUART MACKENZIE, *Bart.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

OBSERVING that the cultivation of sea-cale is one of the subjects on which the Horticultural Society desires information, it may not perhaps be useless, that I should inform you of the method I directed my gardener to follow, several years ago, and which he has since pursued with complete success, producing that admirable vegetable in the greatest perfection. The method probably has nothing new in it; but as sea-cale is not yet very generally known, and as I do not observe any communication respecting it in the first number of your Memoirs, a short statement of my plan, may not be unacceptable.

Two long trenches were dug, and the greatest part of the soil removed from them. The depth was about eighteen inches, and about eight inches of soil were left. A quantity of river sand was then put into the trenches, and spread over the bottom to the thickness of six inches, and then well mixed with the soil below. The trench was now a foot deep, and it was filled six inches more with a very light sandy loam, and the whole dug over again and well mixed. The seed was now sown in a line along the middle of the trench, and as the plants grew, they

they were earthed up, and at last the trenches were reduced to slight hollows. The plants began to show themselves so stout the second year, that I resolved to make use of some of them; and the method I took to blanch them, and which my gardener has practised ever since, was to shake a quantity of dry clean straw loosely over the plants, taking care to remove it whenever it became wet and heavy. Through this light covering the plants shot freely, and remained perfectly white and clean. I have frequently heard gardeners, to whom I recommended this mode of blanching, assert, that straw breaks the plants; but my reply has always been, that they must have been very careless, if ever they had actually tried it. By using the rows alternately, the plants are kept strong; and by being left to grow one season after being cut, they recover their vigour for a renewal of the operation.

It appears to me, better to raise sea-cale from seed, than from offsets, on account of the plants from the former producing larger roots. As this vegetable is really worthy of ample space being allotted to it, over-cutting should be guarded against.

Such is the simple method by which I have been furnished with sea-cale in the highest degree of perfection. But the labours of the gardener are often rendered fruitless by the carelesness of the cook. Sea-cale should be tied into small bundles before being boiled; and it cannot easily be overdone. When taken out of the water, which ought to be perfectly clean, it should be well drained, and allowed to stand a few minutes before the fire, that a considerable portion of the water may evaporate. Sauce, such as may suit the taste of those to whom it is to be served up, may then be poured over it.

I have

I have never had occasion to have this vegetable forced; but though I have not practised it, I may mention to you what has occurred to me as a method simple, and likely to be successful.

Let planks, bricks, or flags, eight or ten inches broad be placed on edge, on each side of the row to be forced, and covered with cross spars, having a space of about an inch between them. Over this let a sufficient quantity of prepared dung be laid, leaving at every ten feet a small part open. The quantity of dung should be such, that the heat may be no more than just enough to *draw up* the plants, to use a gardener's phrase.

On the Utility of Clay-Paint, in destroying various Insects on Fruit-trees, curing Mildew, &c.

By Mr. James Scougal, *of Broughton Place.*

From the Transactions of the Caledonian Horticultural Society.

OBSERVING, that the Caledonian Horticultural Society is desirous of obtaining information on the best method of destroying the coccus, thrips, and fly, infesting various kinds of fruit-trees, on walls and in hot-houses; I shall take the liberty of stating to you, for their information, what has been my practice for many years past, and which, though simple, I can assure you, has been attended with the greatest success.

Take a quantity of the most tenacious brown clay that can be obtained; diffuse it among as much soft water, as will bring it to the consistence of thick cream or paint; pass it through a fine sieve or hair-search, so that it may be made perfectly smooth and unctuous, and free from any gritty particles.

When

When the trees are pruned and nailed in, go over the whole carefully with a painter's brush dipped in the clay-paint, not even missing the young shoots, but more especially the stems and larger branches; this layer, when it becomes dry, forms a hard crust over the whole tree, which enveloping the insects closely, completely destroys them, without doing the smallest injury, either to the bark or buds. By covering the trees with mats or canvass in wet weather, it may be preserved upon the trees as long as is necessary. If one dressing has been found ineffectual, it may be repeated, and the second coating will in general answer the purpose.

It frequently happens, that peach and nectarine trees which have been hard forced, become, what gardeners term *hide-bound;* when that is the case, a good dressing with the clay-paint, whenever they are pruned and tied in, will be attended with admirable effects, especially, when the *dew-syringe* is freely used, after the fires are set a-going, and the houses shut in: by retaining the dewy moisture upon the bark and buds, it nourishes both, makes the flowers much stronger, the fruit set much thicker, and keeps the trees free from insects, when they are in a state most liable to be injured by them. Indeed, I can confidently say, that peach or nectarine trees, managed in this way, will seldom be either hide-bound, or attacked by insects.

Mildew is a disease to which peach and nectarine trees are very liable; but a seasonable application of the clay-paint, is the best cure that I have ever tried, and has the additional recommendation, of not injuring the trees in any stage of growth, which many other applications commonly used are apt to do.

When there are pine-stoves with vines on the rafters, a difficulty which most gardeners have felt, is to get the

eyes

eyes of the vines to break equally; only two or three eyes at the extremity of the shoot generally breaking, where ten or twelve are wished for. I have for several years past, applied the clay-paint to these with the greatest success, and will venture to say, that every eye on a vine-shoot so situated, may be broke with as great certainty as in a vinery: the advantage to them, seems to arise from the clay retaining the moisture upon the shoots and buds for a greater length of time, when watered with the syringe, by which the buds are always kept in a kindly state of moisture.

From the simplicity of the above method, I doubt not there are many who may not think very highly of it; but all I request of these gentlemen, is, that they will give it a fair trial before they condemn it. When I went into Northumberland, where I resided for twelve years, many of my neighbour gardeners ridiculed my new practice in this way; but I had the pleasure of seeing it very generally adopted, and most successfully, before I left the country.

The syringe I used, was one constructed by myself, with brass roses fitted to the end, of different degrees of fineness, so that water might be thrown against the trees in a strong body, or as finely divided as dew: they are to be seen in the different seed-shops in Edinburgh.

Observations on the Treatment of the Currant-bush during the ripening of the Fruit.

By Mr. James Macdonald, *at Dalkeith Park,*

From the Transactions of the Caledonian Horticultural Society.

The plan which I am now to recommend has not, as far as I know, been employed by any other gardener; and with me it has for some years past succeeded far beyond my expectation, both in procuring abundance of fruit, and in increasing their flavour and size.

I prune my bushes in December or January, shortening the last year's shoots from an inch to an inch and an half. I at that time also clean and dig the ground among the bushes. The following spring they make strong shoots, and shew fruit abundantly. But when the fruit arrive at the period of stoning, then is the time when they require every assistance that can be bestowed, to make them swell freely, and to a good size. When, therefore, the fruit begin to shew any colour, which is in general about five or six weeks before they are fit for being pulled, I take the knife and shorten all the young summer-shoots to five or six inches before the fruit. As I find that doing this by means of the knife is tedious, I have for two years past employed hedge-shears for clipping off these shoots. This answers equally well with the knife, and may be done at one-third of the expense. A man may in this way go over half an acre of bushes in a day.

By this method of pruning, at the season when the fruit is ripening, I find that the berries swell to a size full one-half larger than they formerly did with me. But, besides this, it has the farther advantage of giving both sun and air more free access to the fruit. By this means, the

the damp, as it is called, which is often very destructive to currants in wet seasons, is prevented; the *damp* seeming to arise from the bush being too much crowded with superfluous wood, and thus deprived of air.

This practice, therefore, it is my intention to continue; and I trust that it will be found equally advantageous by others who may adopt it. And I may conclude with observing, that several intelligent gardeners, who have seen the fruit produced under this method of treatment, have expressed great admiration, both of the general crop and of the size and flavour of the berries.

On preventing the Maggot infesting the Roots of Shallots, &c. By Mr. WILLIAM HENDERSON, *Gardener to Sir Alexander Muir Mackenzie, of Delvine, Bart.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

THE following very simple mode of preventing the *maggot* from infesting the roots of shallots, and of preventing worms from attacking carrots, you will please to lay before the Caledonian Horticultural Society, at their next quarterly meeting.

In all sorts of soils and aspects, shallots are in general destroyed or much hurt by the maggot; but if my mode of culture be adopted, it will, I trust, be found completely to prevent the depredations of the insect.

I pick out the very smallest of my shallot-roots for planting. I plant about the middle of October, the ground being previously manured with old well rotten dung, or house-ashes. The autumn-planting is the whole secret. By this management, I never have seen the shallots hurt by the maggot in the smallest degree.

 When

When trying this experiment, I had a parcel of spring-planted shallots, only seven feet distance from those planted in the autumn. The spring-planted parcel was totally destroyed by the maggot, while those planted in the autumn, were very productive and good.

The smallness of the roots planted, prevents them from growing mouldy.

The most intense frosts I never have found to hurt the roots in the winter.

I planted last October, in one small bed, 204 shallot-roots, and lifted this August out of the same, above 5000 good clean roots, measuring in general about three and a half inches in circumference.

A preventive against the Worms infesting the Roots of Carrots in light early Soils.

This garden is of a light early soil, and seldom produced a clean crop of carrots, until I adopted the following mode of sowing, which occurred to me in the year 1807, having then got bad carrot-seed, a general complaint at that time.

I sowed the seed about the middle of March; but finding by the 1st of May, that I had a very thin crop, I prepared the other half of the same brake, which was all under celery the year before, and I sowed four times the usual quantity of seed, knowing it to be bad: from this quantity, I obtained a good crop. The early sown, I allowed to stand, although very thin; they were all destroyed by the worms, while those sown on the 1st of May were clean, good, and early enough for a general crop.

Ever since that time, I have sown my principal crop as late as the 1st of May, except in the year 1809, when I made

I made the same experiment again, with the same result as in 1807.

I am now therefore induced to believe, that it is owing to early sowing, that carrots are destroyed by the worm in light early soils.

Account of a successful Rotation of cropping, observed in the Garden at Airthrey Castle.

By Mr. THOMAS KELLY, *Gardener.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

WE have a rotation of cropping here, which, for a number of years, has never failed to give excellent crops. I beg leave to lay it before you, that you may, if you think proper, communicate it to the Horticultural Society.

The first of the rotation is *celery.*

For this crop we choose a piece of poor ground, generally what has been run out by German greens; about the first of July, we lay out two broad ridges seven feet broad, and five feet betwixt them, allowing three feet at each side; then we cast out the space of seven feet, a spading and shovelling deep, laying the earth equally on each side, and filling the ridge a foot deep with dung. The dung we use is from the dunghill where winterings have been going. After smoothing and treading the dung, we cover the whole with about four inches of the earth thrown out, taking great pains in properly planting the celery across the ridge, about fourteen inches row from row. When it is fully earthed up, it will stand four or five feet from the top to the bottom of the ridge. These ridges have several advantages above single rows, or the mode commonly practised. By digging so deep, there

dations of the turnip-fly. A bushel of quicklime is sufficient to dust over an acre of drilled turnips; and a boy may soon be taught to lay it on almost as fast as he could walk along the drills. If the seminal leaves are powdered in the slightest degree, it is sufficient, but should rain wash the lime off before the turnips are in the rough leaf, it may be necessary to repeat the operation, if the fly begin to make its appearance.

Description of a Process for dyeing Silk of a Prussian Blue, so as to give it an uniform, firm, and bright Colour. By M. RAYMOND.

From the BULLETIN DE LA SOCIETE' D'ENCOURAGEMENT.

THE present political circumstances of France render it no longer necessary to seek for methods of replacing, by indigenous substances, the colouring matters that are furnished by the colonies. Yet as the knowledge of an useful process must always have an advantageous influence on the arts, we think that this discovery merits a distinguished place in our transactions.

Prussian blue, which is a colour well known and much used in the arts, is less deep but equally permanent as that which is furnished by indigo. Shades of a clear blue are produced from it upon silk, which have obtained the name of *Maria Louisa* blue, and which are never produced from indigo in a satisfactory manner.

The government having promised a premium of 25,000 franks for the discovery of certain and easy methods of applying Prussian blue to silk and woollen, the commission charged with the examination of the means proposed for the accomplishment of this two-fold object, found that M. Raymond had completely succeeded in that

in a strong ley mixed with sulphur. About the middle of April, this sowing began to rise, and the seminal leaves were fully expanded in two days, when they likewise began to disappear. The next sowing without sulphur, was above ground about the latter end of April; and this, I endeavoured to preserve, by sowing a little soot along the drills; at the same time, I dusted over some rows with coal-ashes, river sand, and road dust, two rows with each. I was surprised to see the fly devouring the turnips dusted with soot so voraciously, that few of them stood one day, and what remained, were totally dispatched next morning, although none were burnt by the soot, it being laid on quite thin. The next that gave way were those covered with ashes; and lastly, those covered with sand, became a prey to the destructive insects.

After a number of other unsuccessful experiments, I tried how quicklime might defend the young turnips from their merciless devourers. I dusted over a few rows with it; and it was washed off about a week after, when I found the turnips uncommonly fresh and green, although they had been almost devoured previous to my applying the lime-dust. I then went on with confidence, dusting all my young turnips the moment I perceived the fly begin to threaten them. Leaving a few rows undusted, to prove the experiment, I found those I left undusted go off rapidly.

I was doubtful that my success was in some measure owing to the advanced state of the season, and the consequent rapid progress of vegetation, but from repeated trials made in the early part of this season with uniform success, I am confirmed in the opinion, that quicklime dusted over the seminal leaves of young turnips, is both an easy and effectual method for preventing the depredations

been previously fixed in it; and the shades of blue, more or less deep, that we can obtain by this process, as well as the permanency of the colour, being in this case dependent upon the greater or less quantity of oxydated iron contained in the silk, as well as on the degree of its oxydation, it results that, we cannot give too much attention to put the solution of sulphate of iron in the most favourable state for accomplishing these different objects.

Thus if the calcination of the copperas be performed in too low a heat, or not long enough continued, there will be hardly any change in the nature of its two constituent principles, and thence its effects as a mordant to attract or fix the prussic acid upon silk, and thereby to produce on it the colour of Prussian blue, will be found to differ very little from those which are produced in similar circumstances by a solution of sulphate of iron not calcined; that is to say, that the silk which is dipped in it, whatever may be the degree of concentration of the solution, will never imbibe more than a small quantity of oxyd of iron, which is the reason that it will not produce any but very weak shades of blue, which are neither bright nor permanent. If on the contrary, the calcination of the copperas be pushed too far, another inconvenience is the consequence, which is, that it entirely decomposes it, so that the only residuum is red oxyd of iron, which is insoluble and entirely deprived of the sulphuric acid which saturated it; this latter being entirely changed to sulphurous acid, and even to sulphur, by yielding to the iron the greatest part of its oxygen, as a consequence of the high temperature it has sustained; so that on diluting in warm water this copperas, which is the residuum of a too long calcination, it does not dissolve a single atom, the super-oxydated oxyd of iron being

being completely deprived of the acid, which would render it soluble in water.

Thus we see how essential it is to stop the calcination at the moment when it is judged that the sulphate of iron has passed to the state of super-oxydated acidulated sulphate of iron, which then reddens the tincture of turnsol; an observation which has been already made by M. Chaptal.

It is easy to seize on the requisite point of calcination, by withdrawing, as I have already directed, the crucible from the fire a few moments after the sulphurous white smoke has shewn itself. Further, a little practice will render this operation extremely easy and certain, which I look upon as one of the most important of any that are employed in dyeing Prussian blue. For I can safely say, that since I have been familiar with it myself, I have never once chanced to fail. We may always be certain that it has perfectly succeeded, when on dissolving a part of the copperas thus calcined in sixteen parts of warm water, it communicates to it a lively yellow colour, a little reddish, and something resembling a slight solution of tan. Its specific gravity should be five degrees of the aerometer for salts.

The solution of sulphate of iron thus calcined to the requisite degree, possesses many advantages over the other sulphuric solutions of this description.

1st. Although exposed to the contact of the air, it constantly retains its transparency and limpidity, without becoming troubled or precipitating any oxyd of iron, which is of very great importance.

2d. Although a considerable quantity of super-oxydated iron be separated from the acid by the effect of the calcination, and this portion of iron remain apart at the time of the filtration or decanting of the liquor, there

still remains enough of it in the liquor, to allow it to act in a very efficacious manner, and I do not fear to say that when employed as a mordant, to produce upon woollen or silk the Prussian blue colour, it has appeared to me to be in a manner inexhaustible in its effects, which I believe may be attributed to the great degree of oxydation to which the iron in it is carried; an oxydation which is the cause, on one part, that the metal is much more disposed to abandon its solvent, and consequently to precipitate itself upon the silk (a circumstance which has already been remarked by M. Berthollet, in his Elements of the Art of Dyeing), and that, on the other part, a very small quantity of the iron thus strongly oxydated, is sufficient to make this metal fix itself in the silk, in a manner extremely apparent, and much more advantageous in its combination with the prussic acid, than it could if the metal were less oxydated.

Second Operation.

When the silk has been prepared in the same manner as when it is to be dyed blue with indigo, and has been well cleansed in the river, from the soapy water, it should be placed on the poles; and afterwards put into the solution of iron, and left in it a longer or shorter time, according to the shade of blue that is wanted; it is then taken out of the vat, to wring it very dry upon a pole which is for this purpose placed over the vat, in order to lose as little as possible of the iron solution; after this the silk is carried to the stream, to be thoroughly cleansed there, which is done by twice beetling it, and plunging and agitating it each time in the running water.

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Observations relative to the Second Operation.

The direction that I give to cleanse the silk with care from the soap, which it always retains after the operation of preparing it for the colour, is very useful, because this manipulation is intended to prevent the solution of sulphate of iron through which the silk is to pass, from being partly decomposed by the alkali contained in the soap, which would produce on one part, soluble sulphate of soda, and on the other, a species of ferruginous metallic soap, which not being soluble, would precipitate upon the silk, on which it would have a very injurious effect, by rendering it either dull, flimsy, and bad coloured, or by glueing the lengths of silk together, so that after this accident they can neither be dyed nor divided. The precaution of washing the silk well in a running stream, and beetling it once or twice, after it is taken out of the iron mordant and well rung, is not less essential, in order that the oxyd of iron may not remain alone fixed in the silk, and that all the sulphate of iron, which remains in it after the wringing, may be entirely taken out, without which it would infallibly happen, that when the silk came to be passed through the bath of prussiate of potash, as will be described in the third operation, it would form in pure waste a double decomposition of the prussiate of iron (Prussian blue), which instead of fixing in the silk, would remain in suspension in the liquor, the transparency of which it would disturb by giving it a blue colour, which would be an obstacle to the perfect combination of the prussic acid with the oxyd of iron fixed in the silk.

It may be known when the silk is sufficiently washed in the river, so as to retain no sulphate of iron, by wringing

wringing a small piece, and receiving the water that comes out of it, into a solution of prussiate of potash: if the mixture of the two liquors takes a blue colour or only a greenish one, it is a proof that the silk retains a remainder of the sulphuric solution of iron, and that it requires to be washed again in the running water in order to free it entirely; for it is necessary to the success of this dye, that the prussiate remain alone upon the silk, without any mixture of sulphate, that its combination with the prussic acid may take place immediately upon the silk, and that the silk may retain the new compound of prussiate of iron by a truly chemical force, which shall prevent it from being detached from the silk either by water or friction.

It is very essential that the solution of iron, through which the silk is passed in order to impregnate it with the mordant of this metal, be always perfectly transparent, and that not a molecule of oxydated iron be held in suspension in it, when the silk comes to be stirred in it; for then the blue colour which it would take up in the vat of prussiate of potash, would be dull, faint, unequal, and not firm, the mordant of oxyd of iron not having been applied to it in the proper manner.

I have likewise discovered that it is not necessary for the solution of acidulated sulphate of iron to be very much concentrated, in order that the silk may imbibe a very great quantity of ferruginous mordant, so as to furnish afterwards very deep shades of blue; but that the same effect may be obtained, with at least as much facility, by a solution less charged with super-oxydated, acidulated sulphate of iron, while the water which this weakened solution contains, facilitates, by its affinity for sulphuric acid, the separation of the metallic oxyd with this acid, and consequently its combination with the silk: it

it is sufficient therefore if the solution of iron be diluted with water enough to disturb its transparency, and to suffer the oxyd of iron to precipitate.

An ounce of green copperas properly calcined in the manner I have before described, dissolved in a pound of water or more, furnishes a solution which remains constantly transparent, even after several months, and which is perfectly in a proper state for fixing in the silk the whole quantity of oxyd of iron with which it is capable of combining, by agitating and moving the silk in it the time necessary for that purpose; this dissolution would even be too much charged with oxyd of iron, for shades of clear blue. If, therefore, these shades are wanted, a very small portion of the solution of acidulated sulphate of iron must be taken and poured into water, which has previously received a little muriatic acid, for the purpose of opposing the precipitation of the oxydated iron, by retaining it in solution.

TO BE CONCLUDED IN OUR NEXT.

Report on M. D'ARCET'S *Method of extracting Gelatine from Bones, and on its Application to various economical Purposes. By Messrs.* LEROUX, DUBOIS, PELLETAN, DUMERIL, *and* VAUQUILIN.

From the ANNALES DE CHIMIE.

M. D'ARCET has presented to the Philanthropic Society, some gelatine extracted from bones, by a process which is peculiarly his own, inviting them to employ this substance in the broths and soups which they distribute to convalescents, and to the poor.

The society accordingly nominated a commission, to enquire into the advantages that may be derived from gelatine

gelatine prepared in M. D'Arcet's manner. After several conferences, in which they were assisted by persons distinguished in chemistry and domestic economy, they were at length satisfied that the use of this substance would afford a considerable saving, and of the possibility of roasting for the nourishment of convalescents, the greatest part of the meat that is otherwise employed in making the broth.

But as the society never adopt any new article of food without previously taking the opinion of the medical faculty, it has submitted to that body the following questions: First, whether the gelatine extracted by M. D'Arcet be nutritive, and to what degree? Secondly, whether it would be salubrious as an aliment, and not liable to any inconvenience?

To these two points the committee have directed their attention, and although the method of preparing the gelatine is not of equal importance with its use as an aliment, we thought it our duty to become acquainted with it, and with this view we visited the manufactory of M. Roberts, where it is extracted, and where we witnessed the series of operations to which the bones are submitted, in order to obtain from them the gelatinous matter in a state perfectly pure.

Hitherto the gelatine has been extracted from bones, by submitting them for a long time to the action of boiling water. By this method, which requires the pulverisation of at least the larger bones, scarcely one third of the gelatine contained in them is obtained; they are besides partly deteriorated by the long continued action of the water and heat; these difficulties have hitherto prevented the adoption in hospitals, of broths made from bones.

M. D'Arcet has followed a method entirely opposite,

he deprives them, by means of diluted muriatic acid, of the phosphate of lime, and obtains the animal part in a solid state, still preserving the form of the bones. To take from this substance the small portions of acid and fat it retains, he puts it into baskets, and plunges it for a few instants into boiling water; lastly, after wiping it dry with linen cloths, he exposes it to a quick current of cold water, which by cleaning it perfectly, renders it white and demi-transparent.

Without entering into further details on this subject, it is enough to observe that M. Roberts' establishment leaves nothing to be desired with respect to cleanliness and salubrity in the preparation of this substance.

When thus prepared and cut into pieces, the gelatine dissolves very quickly and almost entirely in boiling water. If it is wished to preserve it to use at a distant time, it is sufficient to expose it upon hurdles or nets, either entire or cut up, in a warm and dry place; then enclosed in casks or cases it undergoes no alteration, and may be preserved for a thousand years with all its qualities.

Let us now examine, with a view to economy, the advantages of employing M. D'Arcet's gelatine in the preparation of broth. Although this is not the principal object of the author, it is in itself of sufficient importance to merit attention.

It is known that about 100 kilogrammes of meat contain 80 kilogrammes of flesh and fat, and 20 kilogrammes of bones; 100 kilogrammes of meat make in our establishments, 400 measures of broth of a demi-litre each. The bones which are thrown away or burnt would give 30 hundredths of dry gelatine; consequently, the 20 kilogrammes above-mentioned would furnish six kilogrammes, from which 600 measures of broth may be produced.

The quantity of broth produced from the bones is therefore in proportion to that from the meat, as 3 to 2.

But pure gelatine having no taste of its own, is not sufficiently stimulating to the stomachs of invalids and convalescents; M. D'Arcet, therefore, proposes to season the broth with roots and herbs, to supply the place of the extractive matter, the *osmazone* and the salts of the meat; or, as appears preferable, to substitute the gelatine for three-fourths of the meat.

Thus with 50 kilogrammes of meat as much broth may be made of a good quality, as is usually made with 200 kilogrammes; so that the same expense will afford the same quantity of broth, and three-fourths of the meat, which may be roasted for the convalescents, who naturally prefer it to the bouilli of the hospitals, which is nearly reduced to the animal fibres deprived of all the nourishing juice.

Thus the food distributed, will be considerably improved by adopting M. D'Arcet's method, without any additional expense: we will shew this advantage by a few examples.

First, 100 pounds of meat, afford but 50 pounds of bouilli, and 100 pounds of the same meat furnish 67 pounds roasted; there is, therefore, nearly a fifth part gained by roasting it.

Second, 100 pounds of meat, furnish 50 pounds of bouilli, and 200 measures of broth.

Third, 100 pounds of meat, of which 25 is made into broth, with 3 of gelatine, will give 200 measures of broth and 12 pounds and a half of bouilli, and the remaining 75 pounds will furnish 50 pounds of roast meat.

We see that by this means we have an equal quantity of broth of superior quality, and 50 pounds of roast meat, besides

besides 12 pounds and a half of bouilli; indeed we spend 7 francs 50 centimes in the gelatine: but this expense is more than covered by the 12 pounds and a half of bouilli. We must therefore conclude from these facts, that this process affords not only the means of greatly improving the subsistence of the indigent, but also a degree of economy, which is not to be neglected.

This being demonstrated, we will now proceed to the principal object of our mission, which more particularly concerns the medical profession, and the only one on which the society has consulted them, which is, the nutritive properties and salubrity of gelatine.

With respect to the first part of this question, every one who is acquainted with the nature of meat, is convinced that the nutritive property it communicates to the broth, is derived principally, if not entirely, from the gelatine. If daily experience did not furnish undeniable proofs of this, we should find it attested by numberless authors who have written on this subject, and who all consider gelatine as the most nourishing of animal matters. Some persons may object that gelatine cannot supply the place of meat in the preparation of broth, because it is deprived of salts, and of the extract particularly denominated *osmazone*, which gives the colour, taste, and pleasant flavour to broth.

But we reply, that this principle does not exist in veal, poultry, or pork, and yet these meats are very nourishing; and, moreover, M. D'Arcet proposes, as we have before-mentioned, to supply the portions of those substances that are deficient in the broth of gelatine, by a greater quantity of roots, such as onions, turnips, celery, carrots, &c. which are savoury, aromatic, and saline.

But the most conclusive experiment, and one to which every one must assent, was that which was made under our own inspection at the medical hospital. The broth was prepared with one quarter of the meat commonly used, gelatine and roots supplied the place of the other three quarters, which were roasted, and given to the invalids and convalescents, and even to the persons in attendance, who perceived no difference between this broth and that to which they had been used; they were also abundantly nourished, and perfectly satisfied to have roast meat instead of bouilli.

Here then is one part of the question resolved. The broth made according to M. D'Arcet's process, is at least as agreeable as the broth commonly made in hospitals; as to the other part, namely, the salubrity of the broth, we can affirm that of 40 persons who partook of it for three months, not one of them experienced any symptoms that could be reasonably attributed to the gelatine; the progress of the sick was the same as usual, and the convalescent were not longer recovering, than in other circumstances. We may, therefore, without hesitation conclude, that gelatine is not only nourishing and easy of digestion, but also that it is very salubrious, and employed in the way proposed by M. D'Arcet, cannot have any bad effect on the animal frame.

Nor are these the only advantages to be derived from the gelatine extracted in the above manner; there are many others on which I shall add a few words in this place.

1st. When reduced into thin cakes and dried, it may be used by wine merchants in their white wines, also in clarifying coffee, making jellies and creams, and lastly, it may be used instead of isinglass on all occasions.

2d. The

2d. The gelatine simply dried and cut in pieces, contains a great quantity of nourishment in a very small compass; it may be rendered useful to make soup for sailors during long voyages, for soldiers in besieged towns, and even in camps and barracks.

3d. If made into cakes with a certain quantity of gravy and roots, it will make an excellent dish both for the naval and military officers. M. D'Arcet has shewn us some specimens of this preparation, which surpass in beauty and quality all that we have hitherto seen of this kind.

4th and lastly, it can be employed to make glue with more advantage than any other substance that has been used for the purpose; the operation will be much shortened by it, and the glue infinitely better. The tenacity of the latter, according to some experiments made by Messrs. Cadet, Gassicourt, and Jecker, opticians, is to the best Paris glue as 4 to 3, a quality extremely valuable to joiners, cabinet-makers, &c. and especially to paper-makers, who frequently fail in their operations for want of good glue.

It is but justice to add, that M. D'Arcet, by applying to domestic œconomy a known principle in chemistry, has rendered a real service to humanity, since he has demonstrated the utility, for a number of purposes, of a matter which has hitherto been almost entirely lost.

List

List of Patents for Inventions, &c.

(Continued from Vol. XXVI. Page 64.)

JONATHAN RIDGWAY, of Manchester, in the county of Lancaster, Plumber; for a new method of pumping water or other fluids. Dated May 26, 1815.

JOHN PUGH, of Over, in the parish of Whitegate, in the county of Chester, Salt Proprietor; for a new method of making of salt-pans upon an improved principle, to save fuel and labour. Dated May 26, 1815.

JOHN LINGFORD, of Woburn-place, Russel-square, in the parish of Saint George Bloomsbury, in the county of Middlesex, Gent.; for his anatomical self-regulating truss, consisting of a three-quarter or circular spring with an angular moveable joint and end piece, with joint and additional spring to act occasionally with a moveable pad of various shapes, agreeable to the form of the afflicted part of the body, and with elastic spring covering. Dated June 1, 1815.

JOHN KILBY, of City of York, Brewer; for his improvement or improvements in the art of brewing malt-liquors. Dated June 1, 1815.

BENJAMIN STEVENS, of No. 42, Judd-street, St. Pancras, in the county of Middlesex, Gent.; for his improved method of making marine and domestic hard and soft soap. Dated June 3, 1815.

RICHARD TREVITHICK, of Camborne, in the county of Cornwall, Esquire; for certain improvements on the high pressure of steam-engines, and the application thereof, with or without other machinery, to useful purposes. Dated June 6, 1815.

JULIEN JORETT, of Wells-street, Oxford-road, Sweep-washer; JOHN POSTEL, of Great Suffolk-street, Charing Cross,

Cross, in the parish of St. Martin in the Fields, in the county of Middlesex, Gent.; and LEWIS CONTESSE, of Bateman's-buildings, in the parish of St. Anne's Soho, in the county of Middlesex, Jeweller; (in consequence of a communication to them by a foreigner residing abroad) for a method of extracting gold and silver from the cinders of gold refiners and other substances, by means of certain curious machinery. Dated June 8, 1815.

CHARLES WHITLOW, of New-York Coffee-house, Sweeting's-alley, in the county of Middlesex, Botanist; for working or making of certain manufactures from certain plants of the *genus urtica* and *asclipius*, growing in North America, and not heretofore used in this realm, whereby the fabricks or products usually had, made, or obtained from hemp, flax, cotton, silk, and other fibrous materials, or the seeds or the parts thereof, may be beneficially had, made, or obtained. Dated June 14, 1815.

JAMES GARDNER, of Banbury, in the county of Oxford, Machine-maker; for improvements on a machine for cutting hay and straw. Dated June 14, 1815.

WILLIAM POPE, of St. Augustin's-place, in the city of Bristol, Perfumer; for certain improvements in or on wheeled carriages, and also the method or methods of making the said carriages go with or without the assistance of animals, which method or methods may be applied to other purposes. Dated June 14, 1815.

ROBERT BROWN, of Burnham Westgate, in the county of Norfolk, Iron-founder; for certain improvements upon the swing of wheel-ploughs, plough-carriages, and ploughshares. Dated June 14, 1815.

JOHN TAYLOR, of Stratford, in the county of Essex, Manufacturing Chemist; for a mode or means of producing gas to be used for the purpose of affording light. Dated June 14, 1815.

GRACE-

Grace Elizabeth Service, of Arnold-place, Newington, in the county of Surrey, Spinster; for her new methods of manufacturing straw with gause, net, web, and other similar articles, for the purpose of making into hats, bonnets, work-boxes, work-bags, toilet-boxes, and other articles. Dated June 17, 1815.

Charles Silvester, of Derby, in the county of Derby, Engineer; for various improvements in the texture of bobbin lace. Dated June 22, 1815.

Robert Dickinson, of Great Queen-street, Lincoln's-inn-fields, in the county of Middlesex, Esquire; for means for facilitating the propulsion, and for the safety of boats or other vessels through the water. Dated June 22, 1815.

John Taylor, of Stratford, in the county of Essex, Manufacturing Chemist; for certain methods of purifying and refining sugar. Dated June 22, 1815.

Robert Baines, of the Lordship of Myton, in the county of the town of Kingston-upon-Hull, Glue-manufacturer; for his improvements in the construction of vertical windmill-sails. Dated June 22, 1815.

Samuel Balden, of Reddich, in the county of Worcester, Miller; and John Burtonshaw, of Green-street, Bennett's-row, Blackfriars road, in the county of Surrey, Oven-builder; for a machine or instrument for the better heating ovens. Dated June 24, 1815.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLIX. SECOND SERIES. August 1815.

Specification of the Patent granted to William Bell, *of Edinburgh, Writer; for certain Improvements in the Apparatus for copying Manuscripts, or other Writings or Designs.* Dated March 14, 1815.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said William Bell do hereby declare that the said improvements which I have invented consist in certain apparatus, to be used in concert with the common and known method of copying writing by pressure, which was invented originally by Mr. James Watt, and for which his Majesty granted his letters patent to him in the year one thousand seven hundred and eighty. By means of my improved apparatus, copies of manuscript writings or designs can be obtained upon the leaves of a book instead of using separate leaves or pieces of paper, as heretofore practised.

To render this my specification more clear, it is necessary to describe briefly Mr. Watt's invention, which is now generally known and practised in the following manner: The writing or paper to be copied is covered

with a damp-leaf of thin paper, which is made without gum or size. Both are then submitted to a considerable pressure, in any kind of press, or other similar machine, and in a few seconds the water with which the thin paper is damped will absorb or take off part of the ink from the writing; and the said paper being very thin, the ink will penetrate through it, and can be read on the back or opposite side to that which was pressed in contact with the original writing, of which it presents an exact *fac simile.* The ink with which the original writing is made must have some admixture of gummy or mucilaginous matter, which will render it more soluble, and capable of being taken up in part by the damp of the paper. A small quantity of sugar added to common vitriolic ink is known to make it answer this purpose very well.

Now, my improved apparatus is for the purpose of communicating the requisite degree of dampness to the thin paper when it is bound in the form of a book; and the original writing being placed between the leaves of the book, will communicate by pressure part of the ink of the writing to the leaf which is in contact with it, and the copy is thus obtained upon a leaf of the book. The said book is to be formed of any kind of paper which is proper for receiving the copy, by absorbing part of the ink when damped, and which is sufficiently thin for the ink to penetrate its substance, so that it can be read at the back. The book is to be bound in the usual manner, without any other precaution than that the back and front are made equally thick, so that it may be submitted to an equal pressure, also that the paste-boards of the lids, if any are used, are of a parallel and even thickness.

The damping apparatus consists of thin metal plates, cut to the size of the book, and capable of being shut up

therein.

therein. These plates are covered with thin cloth, such as muslin, to receive the damp, also pieces of cloth, flannel, or felt, each a sufficient size to wrap up one damping plate, and cover both sides of it at once. A small tray or pan must be provided, to contain the flannels and plates when damped, which is done either by immersing the sheets of flannel in water, and wringing out the superfluous moisture, by sprinkling them with water when they lay in the pan, or by spreading water over them with a brush, or by any other similar means. The damping plates are then folded in the wet flannel, and put by in the pan: they will be ready for use in a few minutes, when the thin cloth with which the plates are covered has imbibed the moisture.

The operation is thus performed: The paper containing the writing to be copied is to be placed in the book; so that each written surface from which a copy is intended to be taken will lay opposite to the leaf of thin paper whereupon the copy of the writing upon such surface is to be made, then upon the opposite side of each thin leaf which is in contact with a written surface, place a damping plate, prepared as before described. Now, by shutting the book, and exposing it to a pressure, the leaf of thin paper will be inclosed between the written surface and the damping plate; and the pressure producing a contact, the water contained in the muslin with which the plate is covered will quickly penetrate through the thin paper leaf of the book, and dissolve part of the ink of the writing, which part the thin paper will absorb, and thus present a copy of the original writing.

The process takes but a few seconds of time; and in this interval the thin paper receives the dampness as well as the copy, instead of its being previously damped, as in the common process.

To avoid dispersing the dampness unnecessarily through the book, leaves of thick blotting paper, or other paper, are to be applied to those surfaces of the damping plates which have no writing opposed to them, and similar leaves are to be shut up in the book after the operation is finished, in order to dry the damp leaves. Leaves of pasteboard, water-proof leather, or other similar substance, which is capable of containing moisture in small quantities, may be used in lieu of the damping plates; but I have found by experience that metal plates covered with thin cloth answer the purpose better, being less liable to grow musty from the dampness. Any kind of metal may be used; but that which is least liable to rust will be best; or the metal may be varnished, japanned, or turned, for this purpose. The plates may be damped by folding them in wet flannel, as before described, or felt, or woollen, linen, or cotton, or any other kind of cloth, may be used for the same purpose, as it is only intended by means of them to communicate a regular and slight degree of dampness to the plates, or other substance used in lieu thereof.

The apparatus for producing the pressure may be a screw press, lever press, hydrostatic press, or rolling press, or any other kind of press known or in use, as my improvements do not extend to this part of the original apparatus.

In witness whereof, &c.

Observations by the Patentee.

The advantages attending my patent are various:

First. The *copy* of the writing is more perfect, and the *original* is less injured by the new than by the old process.

Second.

Second. The copy is taken at once into a book instead of upon detached half sheets of paper; and thereby

Third. The copies are rendered good evidence in a court of law; which by the old process was held not to be the case.

Fourth. In consequence it may be used for taking duplicates of accounts, and many other papers besides letters, to which the former mode was chiefly confined.

I may farther add, that the new method excels the former much in the facility and ease with which it may be used; and that the paper in the book on which the copy is to be taken requires no previous preparing, the paper being damped by the new apparatus at the same moment and by the same process by which the copy is taken.

Specification of the Patent granted to WILLIAM HOWARD, *of Old Brentford, in the County of Middlesex, Gentleman; for an improved Apparatus for working the Pumps on-board Ships, which may also be applied to Churning, and various other useful Purposes.*

Dated November 10, 1814.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Howard do hereby describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, as follows; that is to say: My said invention is represented in the perspective drawing, Fig. 1, (Plate V.) hereto annexed, and consists of the application of cranks upon a spindle, supported by stancheons, as there seen, to which cranks the

the pump or piston rods are attached and put in motion by the revolution of the said spindle by means of bevel cog wheels, acting at right angles, and a handle and fly wheel, to give motion, as there represented, but more fully described by the following figures.

Fig. 2, in the said drawing hereto annexed, exhibits a horizontal view of the apparatus, supported by the stancheons *a*, *b b*, *c*, and *d*. And Fig. 3, in the said annexed drawing, exhibits a side view of that part of the apparatus which is supported by the middle stancheons *b b* and *d*, the same letters referring to the same respective parts in every figure. A A are cranks, to which the pump or piston rods are to be attached, and which cranks are affixed to the square ends of spindle by bolt-screw, or other means, or may be made in one piece with the spindle, B B the spindle, supported upon the stancheons *a*, *b*, and *c*, as seen in Fig. 1. C the bevel cog wheel, fitted to a square on the spindle against the shoulder D, and fastened with a pin or bolt. E the lesser bevel cog-wheel, working into the greater cog wheel C at right angles, fixed upon the fly wheel arbour F F, which arbour is supported by the stancheons *b b* and *d*, as seen in Fig. 3. G the fly wheel and H the handle, to give motion to the apparatus. When a greater power is required take off the cog wheel E from the fly wheel arbour, and substitute one of smaller diameter, as E 1, when it will be necessary to place a collar I upon the spindle between the cog wheel C and the shoulder D, in order to bring the bevel wheel C to act into the teeth of the lesser wheel.

Fig. 4 in the said annexed drawing represents a horizontal view of a different application of wheels for working the spindle and cranks. In this figure the cog wheels work into each other in a right line. A A the cranks.

Fig. 1.

Fig. 3.

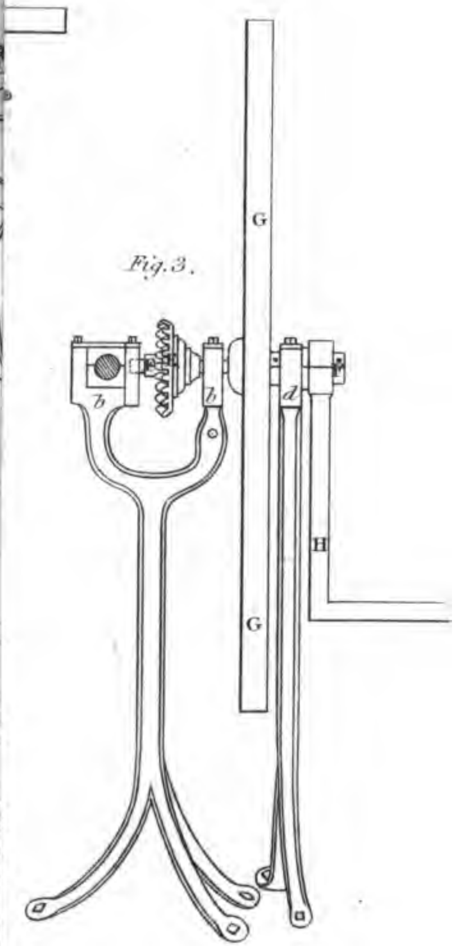


Fig. 5.

C the cog wheel, fitted on the square of the spindle B, which is supported by the stancheons *e* and *f*. E the lesser cog wheel fitted on the square of the fly wheel arbour F, and supported by the stancheons *f* and *g*.

The side view of the middle stancheon *f f* is represented in Fig. 5 in the annexed drawing, and shew the manner in which the cog wheels work into each other. The fly wheel in this case may be affixed on either side of the stancheon *g*, and the handle fitted on a square at the end of the arbour, or the handle may be continued as a crank across the deck, (enabling several men to work it) and supported by another stancheon at its extremity, in which case the fly wheel can be made to work in the ship's side, with a square on the inside to receive the crank, and a square on the outside, to which a water wheel can be applied to render the apparatus self-acting.

To accelerate the action of the pumps worked upon the latter principle, a cog wheel of larger diameter may be substituted instead of the cog wheel E, Figs. 4 and 5, in which case the brass dies K, fitted in the stancheons *f* and *g*, may be turned round in their places, the holes for the arbour to turn in being at that distance from the centre of the dies as the semi-diameter of the cog wheel E 2 is larger than the one for which it is substituted.

All the figures except the perspective view, Fig. 1, are drawn upon a scale of three inches to the foot, but I do not intend confining myself precisely to these dimensions.

In witness whereof, &c.

Specification

Specification of the Patent granted to BAZILE LOUIS MERTIAN, *of Threadneedle-street, in the City of London, Gentleman; for a Method of extracting or separating Jelly, or gelatinous Matter, from Substances capable of affording the same, in order that the same may be used in the Arts, or for domestic or other Purposes.*

Dated July 12, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Bazile Louis Mertian do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in manner following; that is to say: I do operate upon such animal substances as contain jelly, or gelatinous matter, but do not with facility afford or give out the whole of the said jelly, or gelatinous matter, by merely boiling or macerating such substances with water alone. And the said substances do chiefly consist of the bony, hard, or cartilaginous parts of animals: and that I do break, crush, chop in pieces, or otherwise divide, such of the said substances as by their structure do require the internal parts thereof to be laid open, and accessible to the fluid to be made use of for extracting or obtaining the jelly therefrom. And I do, if convenient or desirable, in the first place boil the said substances with water alone, in order to extract a first proportion of jelly (to which method of extraction I claim no exclusive right or privilege). And I do afterwards operate upon the residue according to the process of my said invention, as herein specified and explained; or otherwise I do afterwards apply and use my said invention to and with the said substances without such previous boiling with water alone. And, farther, I do put

into

into a vessel or vessels of white wood or lead, or other material capable of withstanding the action of diluted acid, one hundred parts, by weight, of the said substance, so if need be, broken, crushed, chopped, or divided, or of the residue left after boiling with water alone, as aforesaid, along with four hundred parts, by weight, or thereabout, of muriatic acid, diluted with water until the specific gravity thereof shall be about 1040 compared with the weight of pure water assumed to be expressed by the number 1000. And I do stir the mixture daily until the bony, hard, or cartilaginous parts shall have become soft; and I do then separate the acid by decantation, or otherwise, and I do wash the said softened parts with repeated waters; and I do, by means of a press or otherwise, separate and press out most part of the acid liquor which may remain in the said softened parts, and do again carefully wash the same with water; and the said softened parts may then be either dried for keeping, or be converted into jelly or size, or glue, by solution in heated water as usual. And, moreover, in case the said softened parts should not be readily soluble in water, (which will happen if the washing be carried too far,) this defect will be removed by adding a small portion of muriatic acid, or diluted sulphuric acid, or of vinegar. And that in case the acid either left in or added to the said softened parts should be more than would be sufficient to produce the due solubility, then the gelatine will be afforded in a viscid state, which when dry is easily reducible to powder; but the proper management in the said respects must and may be easily ascertained by trial.

And I do farther declare, that if the muriatic acid first to be used and applied be more diluted than is hereinbefore mentioned, as, for example, to the specific gravity of 1020, the process will be slower, and the product

will be more similar to isinglass in its qualities; but that in the large way it is preferable that the acid should be somewhat stronger than last-mentioned. And, lastly, that the fat which is separated and floats upon the acid made use of, and the phosphate of lime contained in the said acid liquor, and also the acid itself, may be separated and applied to use by well-known methods, heretofore practised by chemists in the treatment of such substances.

And, lastly, I do declare, that in case the operator should not be provided with muriatic acid for performing the process of softening the animal substance, as is firstly herein mentioned and described, then he may make use of either the nitric, or the phosphoric, or the acetous acids, of such strength and in such proportions, and during such times of maceration, as by simple and easy trials upon each respective animal substances, shall be found most suitable to such substances respectively, without exercising any farther or more powerful action upon the same than is or may be requisite for the purposes hereinbefore set forth.

In witness whereof, &c.

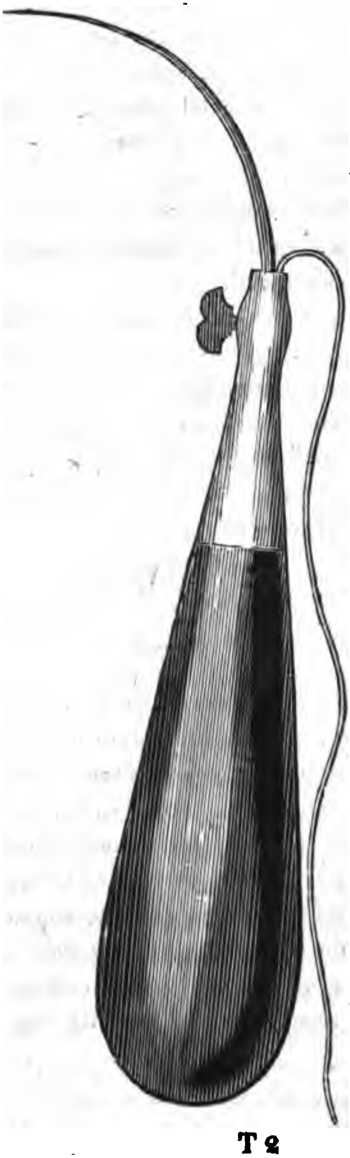
Description of an Instrument for performing Surgical Operations. By Mr. John Bottomley.

Communicated in a Letter to the Editors.

Gentlemen, *Scarborough, June 30, 1815.*

WITNESSING some months ago a slight surgical operation, I felt distressed at the pain occasioned to the patient by the rude simplicity of the instrument employed. It was merely a needle, over which the operator, although dexterous, had so little power, that a long-continued effort was necessary; and, I have been informed

formed, that in some cases the needle is several minutes in being passed through the flesh. Learning, on enquiry,



 that

that it was the only instrument employed on such occasions, I was led to the suggestion of a little contrivance, which I have the satisfaction to state has since been tried, and found to obviate every former inconvenience. It is of the most simple description, as you will perceive by the annexed sketch, being nothing more than a short handle; into a hole in the end of which the needle and thread are thrust, and there held by a small screw, until it becomes necessary to detach them, in order to the drawing of the thread through the hole which the needle has pierced.

Conceiving it my duty to give publicity to this little improvement, and not knowing how to do it better than through the medium of your valuable work, I have to request that you will be so kind as to take an early opportunity of giving this communication to the public; in doing which you will, I trust, subserve the interests of humanity, and will oblige,

Yours, &c.

JOHN BOTTOMLEY.

P.S. I seize the opportunity to supply a trifling correction in your copy of my memorial to the Lords of the Treasury. Omitting the words "*number and,*" which occur in page 20, line 11, from the top, of your last volume, and the words "*their number and,*" which occur in lines 19 and 20 from the top of the same page, your readers will be pleased to add the following sentence at the close of the paragraph. *When only some of the rollers are inclined (for it is not in every case designed to incline them all) the number inclined must likewise be considered.*

On

On Agricultural Chemistry.

Extracted from Sir Humphry Davy's Lectures.

On Manures of mineral Origin, or fossile Manures; their Preparation, and the Manner in which they act. Of Lime in its different States; Operation of Lime as a Manure and a Cement; different Combinations of Lime. Of Gypsum; Ideas respecting its Use. Of other neutro-saline Compounds, employed as Manures. Of Alkalies and alkaline Salts; of Common Salt,

IT has been shewn, that a great variety of substances contribute to the growth of plants, and supplies the materials of their nourishment. The conversion of matter that has belonged to living structures into organised forms is a process that can be easily understood; but it is more difficult to follow those operations by which earthy and saline matters are consolidated in the fibre of plants, and by which they are made subservient to their functions. Some enquirers adopting that sublime generalisation of the antient philosophers, that matter is the same in essence, and that the different substances considered as elements by chemists, are merely different arrangements of the same indestructible particles, have endeavoured to prove, that all the varieties of the principles found in plants may be formed from the substances in the atmosphere; and that vegetable life is a process in which bodies that the analytical philosopher is unable to change or to form, are constantly composed and decomposed. These opinions have not been advanced merely as hypotheses; attempts have been made to support them by experiments. M. Schrader and Mr. Braconnot, from a series of distinct investigations, have arrived at the same conclusions. They state that different

seeds

seeds sown in fine sand, sulphur, and metallic oxyds, and supplied only with atmospherical air and water, produced healthy plants, which by analysis yielded various earthy and saline matters, which either were not contained in the seeds, or the material in which they grew; or which were contained only in much smaller quantities in the seeds: and hence they conclude that they must have been formed from air or water, in consequence of the agencies of the living organs of the plant.

The researches of these two gentlemen were conducted with much ingenuity and address; but there were circumstances which interfered with their results, which they could not have known, as at the time their labours were published they had not been investigated.

I have found that common distilled water is far from being free from saline impregnations. In analising it by Voltaic electricity, I procured from it alkalies and earths; and many of the combinations of metals with cholrine are extremely volatile substances. When distilled water is supplied in an unlimited manner to plants, it may furnish to them a number of different substances, which, though in quantities scarcely perceptible in the water, may accumulate in the plant, which probably perspires only absolutely pure water.

In 1801 I made an experiment on the growth of oats, supplied with a limited quantity of distilled water in a soil composed of pure carbonate of lime. The soil and the water were placed in a vessel of iron, which was included in a large jar, connected with the free atmosphere by a tube, so curved as to prevent the possibility of any dust, or fluid, or solid matter, from entering into the jar. My object was to ascertain whether any siliceous earth would be formed in the process of vegetation; but the oats grew very feebly, and began to be yellow before any

flowers

flowers formed: the entire plants were burnt, and their ashes compared with those from an equal number of grains of oat. Less siliceous earth was given by the plants than by the grains; but their ashes yielded much more carbonate of lime. That there was less siliceous earth I attribute to the circumstance of the husk of the oat being thrown off in germination; and this is the part which most abounds in silica. Healthy green oats, taken from a growing crop, in a field of which the soil was a fine sand, yielded siliceous earth in a much greater proportion than an equal weight of the corn artificially raised.

The general results of this experiment are very much opposed to the idea of the composition of the earths, by plants, from any of the elements found in the atmosphere or in water; and there are other facts contradictory to the idea. Jacquin states that the ashes of glass wort (*Salsola soda*), when it grows in inland situations, afford the vegetable alkali; when it grows on the sea-shore, where compounds which afford the fossile or marine alkali are more abundant, it yields that substance. Du Hamel found, that plants which usually grow on the sea-shore made small progress when planted in soils containing little common salt. The sunflower, when growing in lands containing no nitre, does not afford that substance; though when watered by a solution of nitre it yields nitre abundantly. The tables of de Saussure shew that the ashes of plants are similar in constitution to the soils in which they have vegetated.

De Saussure made plants grow in solutions of different salts, and he ascertained, that in all cases certain portions of the salts were absorbed by the plant, and found unaltered in their organs.

Even animals do not appear to possess the power of forming the alkaline and earthy substances. Dr. Fordyce found,

found, that when canary birds, at the time they were laying eggs, were deprived of access to carbonate of lime, their eggs had soft shells; and if there is any process for which nature may be conceived most likely to supply resources of this kind, it is that connected with the reproduction of the species.

As the evidence on the subject now stands, it seems fair to conclude, that the different earths and saline substances found in the organs of plants are supplied by the soils in which they grow; and in no cases composed by new arrangements of the elements in air or water. What may be our ultimate view of the laws of chemistry, or how far our ideas of elementary principles may be simplified, it is impossible to say. We can only reason from facts. We cannot imitate the powers of composition belonging to vegetable structures; but at least we can understand them: and as far as our researches have gone, it appears, that in vegetation compound forms are uniformly produced from simpler ones; and the elements in the soil, the atmosphere, and the earth absorbed and made parts of beautiful and diversified structures.

The views which have been just developed lead to correct ideas of the operation of these manures which are not necessarily the result of decayed organised bodies, and which are not composed of different proportions of carbon, hydrogen, oxygen, and azote.—They must produce their effect, either by becoming a constituent part of the plant, or by acting upon its more essential food, so as to render it more fitted for the purposes of vegetable life.

The only substances which can with propriety be called fossile manures, and which are found unmixed with the remains of any organised beings, are certain alkaline earths or alkalies, and their combinations.

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The only alkaline earths which have been hitherto applied in this way are lime and magnesia. Potassa and soda, the two fixed alkalies, are both used in certain of their chemical compounds. I shall state in succession such facts as have come to my knowledge respecting each of these bodies in their applications to the purposes of agriculture; but I shall enlarge most upon the subject of lime; and if I should enter into some details which may be tedious and minute, I trust my excuse will be found in the importance of the inquiry; and it is one which has been greatly elucidated by late discoveries.

The most common form in which lime is found on the surface of the earth is in a state of combination with carbonic acid or fixed air. If a piece of limestone, or chalk, be thrown into a fluid acid, there will be an effervescence. This is owing to the escape of the carbonic acid gas. The lime becomes dissolved in the liquor.

When limestone is strongly heated, the carbonic acid gas is expelled, and then nothing remains but the pure alkaline earth; in this case there is a loss of weight; and if the fire has been very high it approaches to one-half the weight of the stone; but in common cases limestones, if well dried before burning, do not lose much more than from 35 to 40 *per cent.* or from seven to eight parts out of twenty.

I mentioned in discussing the agencies of the atmosphere upon vegetables, that air always contains carbonic acid gas, and that lime is precipitated from water by this substance. When burnt lime is exposed to the atmosphere, in a certain time it becomes mild, and is the same substance as that precipitated from lime-water; it is combined with carbonic acid gas. Quick-lime, when first made, is caustic and burning to the tongue, renders vegetable blues green, and is soluble in water; but when

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combined with carbonic acid it loses all these properties, its solubility, and its taste: it regains its power of effervescing, and becomes the same chemical substance as chalk or limestone.

Very few limestones or chalks consist entirely of lime and carbonic acid. The statuary marbles, or certain of the rhomboidal spars, are almost the only pure species; and the different properties of limestones, both as manures and cements, depend upon the nature of the ingredients mixed in the limestone; for the true calcareous element, the carbonate of lime, is uniformly the same in nature, properties, and effects, and consists of one proportion of carbonic acid 41.4, and one of lime 55.

When a limestone does not copiously effervesce in acids, and is sufficiently hard to scratch glass, it contains siliceous, and probably aluminous earth. When it is deep brown, or red, or strongly coloured of any of the shades of brown or yellow, it contains oxyd of iron. When it is not sufficiently hard to scratch glass, but effervesces slowly, and makes the acid in which it effervesces milky, it contains magnesia. And when it is black, and emits a fœtid smell if rubbed, it contains coaly or bituminous matter.

The analysis of limestones is not a difficult matter; and the proportions of their constituent parts may be easily ascertained, by the processes described in the Lecture on the Analysis of Soils; and usually with sufficient accuracy for all the purposes of the farmer by the fifth process.

Before any opinion can be formed of the manner in which the different ingredients in limestones modify their properties, it will be necessary to consider the operation of the pure calcareous element as a manure and as a cement.

Quick-

Quick-lime in its pure state, whether in powder or dissolved in water, is injurious to plants.—I have in several instances killed grass by watering it with lime-water.—But lime, in its state of combination with carbonic acid, is a useful ingredient in soils. Calcareous earth is found in the ashes of the greater number of plants; and exposed to the air, lime cannot long continue caustic, for the reasons that were just now assigned, but soon becomes united to carbonic acid.

When newly-burnt lime is exposed to air it soon falls into powder; in this case it is called slacked lime; and the same effect is immediately produced by throwing water upon it, when it heats violently, and the water disappears.

Slacked-lime is merely a combination of lime, with about one-third of its weight of water; *i. e.* fifty-five parts of lime absorb seventeen parts of water; and in this case it is composed of a definite proportion of water, and is called by chemists *hydrate of lime;* and when hydrate of lime becomes carbonate of lime by long exposure to air the water is expelled, and the carbonic acid gas takes its place.

When lime, whether freshly burnt or slacked, is mixed with any moist fibrous vegetable matter, there is a strong action between the lime and the vegetable matter, and they form a kind of compost together, of which a part is usually soluble in water.

By this kind of operation lime renders matter, which was before comparatively inert, nutritive; and as charcoal and oxygen abound in all vegetable matters, it becomes at the same time converted into carbonate of lime.

Mild lime, powdered limestone, marles, or chalks, have no action of this kind upon vegetable matter; by their

action they prevent the too rapid decomposition of substances already dissolved; but they have no tendency to form soluble matters.

It is obvious from these circumstances, that the operation of quick-lime, and marle or chalk, depends upon principles altogether different.—Quick-lime, in being applied to land, tends to bring any hard vegetable matter that it contains into a state of more rapid decomposition and solution, so as to render it a proper food for plants. —Chalk and marle, or carbonate of lime, will only improve the texture of the soil, or its relation to absorption; it acts merely as one of its earthy ingredients.—Quick-lime, when it becomes mild, operates in the same manner as chalk; but in the act of becoming mild, it prepares soluble out of insoluble matter.

It is upon this circumstance that the operation of lime in the preparation for wheat crops depends; and its efficacy in fertilising peats, and in bringing into a state of cultivation all soils abounding in hard roots or dry fibres, or inert vegetable matter.

The solution of the question, whether quick-lime ought to be applied to a soil, depends upon the quantity of inert vegetable matter that it contains. The solution of the question, whether marle, mild lime, or powdered limestone, ought to be applied, depends upon the quantity of calcareous matter already in the soil. All soils are improved by mild lime, and ultimately by quick-lime, which do not effervesce with acids: and sands more than clays.

When a soil deficient in calcareous matter contains much *soluble* vegetable manure, the application of quick-lime should always be avoided, as it either tends to decompose the soluble matters by uniting to their carbon and oxygen so as to become mild lime, or it combines with

with the soluble matters, and forms compounds having less attraction for water than the pure vegetable substance.

The case is the same with respect to most animal manures; but the operation of the lime is different in different cases, and depends upon the nature of the animal matter. Lime forms a kind of insoluble soap with oily matters, and then gradually decomposes them by separating from them oxygen and carbon. It combines likewise with the animal acids, and probably assists their decomposition by abstracting carbonaceous matter from them combined with oxygen; and consequently it must render them less nutritive. It tends to diminish likewise the nutritive powers of albumen from the same causes; and always destroys, to a certain extent, the efficacy of animal manures, either by combining with certain of their elements, or by giving to them new arrangements. Lime should never be applied with animal manures, unless they are too rich, or for the purpose of preventing noxious effluvia, as in certain cases mentioned in the last Lecture. It is injurious when mixed with any common dung, and tends to render the extractive matter insoluble.

I made an experiment on this subject: I mixed a quantity of brown soluble extract, which was procured from sheeps' dung with five times its weight of quick-lime: I then moistened them with water; the mixture heated very much; it was suffered to remain for fourteen hours, and was then acted on by six or seven times its bulk of pure water: the water, after being passed through a filter, was evaporated to dryness; the solid matter obtained was scarcely coloured, and was lime mixed with a little saline matter.

In those cases in which fermentation is useful to produce nutriment from vegetable substances lime is always efficacious. I mixed some moist tanner's spent bark with

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one-fifth of its weight of quick-lime, and suffered them to remain together in a close vessel for three months; the lime had become coloured, and was effervescent: when water was boiled upon the mixture it gained a tint of fawn colour, and by evaporation furnished a fawn-coloured powder, which must have consisted of lime united to vegetable matter, for it burnt when strongly heated, and left a residuum of mild lime.

The limestones containing alumina and silica are less fitted for the purposes of manure than pure limestones; but the lime formed from them has no noxious quality. Such stones are less efficacious, merely because they furnish a smaller quantity of quick-lime.

I mentioned bituminous limestones. There is very seldom any considerable portion of coaly matter in these stones; never as much as five parts in 100; but such limestones make very good lime. The carbonaceous matter can do no injury to the land, and may, under certain circumstances, become a food of the plant, as is evident from what was stated in the last Lecture.

The subject of the application of the magnesian limestone is one of great interest.

It had been long known to farmers in the neighbourhood of Doncaster, that lime made from a certain limestone applied to the land often injured the crops considerably. Mr. Tennant, in making a series of experiments upon this peculiar calcareous substance, found that it contained magnesia; and on mixing some calcined magnesia with soil, in which he sowed different seeds, he found that they either died or vegetated in a very imperfect manner, and the plants were never healthy. And with great justice and ingenuity he referred the bad effects of the peculiar limestone to the magnesian earth it contains.

In making some inquiries concerning this subject, I found that there were cases in which this magnesian limestone was used with good effect.

Amongst some specimens of limestone which Lord Somerville put into my hands, two marked as peculiarly good proved to be magnesian limestones. And lime made from the Breedon limestone is used in Leicestershire, where it is called hot lime; and I have been informed by farmers in the neighbourhood of the quarry, that they employ it advantageously in small quantities, seldom more than 25 or 30 bushels to the acre. And that they find it may be used with good effect in larger quantities upon rich land.

A minute chemical consideration of this question will lead to its solution.

Magnesia has a much weaker attraction for carbonic acid than lime, and will remain in the state of caustic or calcined magnesia for many months, though exposed to the air. And as long as any caustic lime remains, the magnesia cannot be combined with carbonic acid, for lime instantly attracts carbonic acid from magnesia.

When a magnesian limestone is burnt, the magnesia is deprived of carbonic acid much sooner than the lime; and if there is not much vegetable or animal matter in the soil to supply by its decomposition carbonic acid, the magnesia will remain for a long while in the caustic state; and in this state acts as a poison to certain vegetables. And that more magnesian lime may be used upon rich soils seems to be owing to the circumstance, that the decomposition of the manure in them supplies carbonic acid. And magnesia in its mild state, *i. e.* fully combined with carbonic acid, seems to be always an useful constituent of soils. I have thrown carbonate of magnesia (procured by boiling the solution of magnesia in super-

super-carbonate of potassa) upon grass, and upon growing wheat and barley, so as to render the surface white; but the vegetation was not injured in the slightest degree. And one of the most fertile parts of Cornwall, the Lizard, is a district in which the soil contains mild magnesian earth.

The Lizard Downs bear a short and green grass, which feeds sheep, producing excellent mutton; and the cultivated parts are amongst the best corn lands in the county.

That the theory which I have ventured to give of the operation of magnesian lime is not unfounded, is shewn by an experiment which I made expressly for the purpose of determining the true nature of the operation of this substance. I took four portions of the same soil: with one I mixed one-twentieth of its weight of caustic magnesia, with another I mixed the same quantity of magnesia and a proportion of a fat decomposing peat equal to one-fourth of the weight of the soil. One portion of soil remained in its natural state; and another was mixed with peat without magnesia. The mixtures were made in December 1806, and in April 1807 barley was sown in all of them. It grew very well in the pure soil, but better in the soil containing the magnesia and peat; and nearly as well in the soil containing peat alone: but in the soil containing the magnesia alone it rose very feeble, and looked yellow and sickly.

I repeated this experiment in the summer of 1810 with similar results; and I found that the magnesia in the soil mixed with peat became strongly effervescent, whilst the portion in the unmixed soil gave carbonic acid in much smaller quantities. In the one case the magnesia had assisted in the formation of a manure, and had become mild; in the other case it had acted as a poison.

It is obvious, from what has been said, that lime from the

the magnesian limestone may be applied in large quantities to peats; and that where lands have been injured by the application of too large a quantity of magnesian lime, peat will be a proper and efficient remedy.

I mentioned that magnesian limestones effervesced little when plunged into an acid. A simple test of magnesia in a limestone is this circumstance, and its rendering diluted nitric acid or aqua fortis milky.

From the analysis of Mr. Tennant, it appears that the magnesian limestones contain from

20.3 to 22.5 magnesia.
29.5 to 31.7 lime.
47.2 carbonic acid.
0.8 clay and oxyd of iron.

Magnesian limestones are usually coloured brown or pale yellow. They are found in Somersetshire, Leicestershire, Derbyshire, Shropshire, Durham, and Yorkshire. I have never met with any in other counties in England; but they abound in many parts of Ireland, particularly near Belfast.

The use of lime as a cement is not a proper subject for extensive discussion in a course of lectures on the chemistry of agriculture; yet as the theory of the operation of lime in this way is not fully stated in any elementary book that I have perused, I shall say a very few words on the applications of this part of chemical knowledge.

There are two modes in which lime acts as a cement; in its combination with water, and in its combination with carbonic acid.

The hydrate of lime has been already mentioned. When quick lime is rapidly made into a paste with water, it soon loses its softness, and the water and the lime form

form together a solid coherent mass, which consists, as has been stated before, of 17 parts of water to 55 parts of lime. When hydrate of lime, whilst it is consolidating, is mixed with red oxyd of iron, alumina, or silica, the mixture becomes harder and more coherent than when lime alone is used; and it appears that this is owing to a certain degree of chemical attraction between hydrate of lime and these bodies; and they render it less liable to decompose by the action of the carbonic acid in the air, and less soluble in water.

The basis of all cements that are used for works which are to be covered with water must be formed from hydrate of lime; and the lime made from impure limestones answers this purpose very well. Puzzolana is composed principally of silica, alumina, and oxyd of iron; and it is used mixed with lime, to form cements intended to be employed under water. Mr. Smeaton, in the construction of the Eddystone light-house, used a cement, composed of equal parts by weight, of slacked lime and puzzolana. Puzzolana is a decomposed lava. Tarras, which was formerly imported in considerable quantities from Holland, is a mere decomposed basalt: two parts of slacked lime and one part of tarras forms a principal part of the mortar used in the great dykes of Holland. Substances which will answer all the ends of puzzolana and tarras are abundant in the British islands. An excellent red terras may be procured in any quantities from the Giant's Causeway, in the North of Ireland: and decomposing basalt is abundant in many parts of Scotland, and in the northern districts of England in which coal is found.

Parker's cement, and cements of the same kind made at the alum works of Lord Dundas and Lord Mulgrave, are mixtures of calcined ferruginous, silicious, and aluminous matter, with hydrate of lime.

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The cements which act by combining with carbonic acid, or the common mortars, are made by mixing together slacked lime and sand. These mortars at first solidify as hydrates, and are slowly converted into carbonate of lime by the action of the carbonic acid of the air. Mr. Tennant found that a mortar of this kind in three years and a quarter had regained 63 *per cent.* of the quantity of carbonic acid gas which constitutes the definite proportion in carbonate of lime. The rubbish of mortar from houses owes its power to benefit lands principally to the carbonate of lime it contains, and the sand in it; and its state of cohesion renders it particularly fitted to improve clayey soils.

The hardness of the mortar in very old buildings depends upon the perfect conversion of all its parts into carbonate of lime. The purest limestones are the best adapted for making this kind of mortar; the magnesian limestones make excellent water cements, but act with too little energy upon carbonic acid gas to make good common mortar.

The Romans, according to Pliny, made their best mortar a year before it was used; so that it was partially combined with carbonic acid gas before it was employed.

In burning lime there are some particular precautions required for the different kinds of limestones. In general one bushel of coal is sufficient to make four or five bushels of lime. The magnesian limestone requires less fuel than the common limestone. In all cases in which a limestone containing much aluminous or siliceous earth is burnt, great care should be taken to prevent the fire from becoming too intense; for such lime easily vitrifies, in consequence of the affinity of lime for silica and alumina. And, as in some places there are no other limestones than such as contain other earths, it is im-

portant to attend to this circumstance. A moderately good lime may be made at a low red heat; but it will melt into a glass at a white heat. In limekilns for burning such lime there should be always a damper.

In general, when limestones are not magnesian, their purity will be indicated by their loss of weight in burning; the more they lose the larger is the quantity of calcareous matter they contain. The magnesian limestones contain more carbonic acid than the common limestones; and I have found all of them lose more than half their weight by calcination.

Besides being used in the forms of lime and carbonate of lime, calcareous matter is applied for the purposes of agriculture in other combinations. One of these bodies is *gypsum* or sulphate of lime. This substance consists of sulphuric acid (the same body that exists combined with water in oil of vitriol) and lime; and when dry it is composed of 55 parts of lime and 75 parts of sulphuric acid. Common gypsum, or selenite, such as that found at Shotover Hill, near Oxford, contains, besides sulphuric acid and lime, a considerable quantity of water; and its composition may be thus expressed:

Sulphuric acid one proportion	75
Lime one proportion	55
Water two proportions	34

The nature of gypsum is easily demonstrated; if oil of vitriol be added to quick-lime there is a violent heat produced; when the mixture is ignited, water is given off, and gypsum alone is the result, if the acid has been used in sufficient quantity; and gypsum mixed with quick-lime, if the quantity has been deficient. Gypsum, free from water, is sometimes found in nature, when it is called anhydrous selenite. It is distinguished from common gypsum by giving off no water when heated.

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When gypsum, free from water, or deprived of water by heat, is made into a paste with water, it rapidly sets by combining with that fluid. Plaster of Paris is powdered dry gypsum, and its property as a cement, and in its use in making casts, depends upon its solidifying a certain quantity of water, and making with it a coherent mass. Gypsum is soluble in about 500 times its weight of cold water, and is more soluble in hot water; so that when water has been boiled in contact with gypsum, crystals of this substance are deposited as the water cools. Gypsum is easily distinguished by its properties of affording precipitates to solutions of oxalates and of barytic salts.

Great difference of opinion has prevailed amongst agriculturists with respect to the uses of gypsum. It has been advantageously used in Kent, and various testimonies in favour of its efficacy have been laid before the Board of Agriculture by Mr. Smith. In America it is employed with signal success; but in most counties of England it has failed, though tried in various ways, and upon different crops.

Very discordant notions have been formed as to the mode of operation of gypsum. It has been supposed by some persons to act by its power of attracting moisture from the air; but this agency must be comparatively insignificant. When *combined* with water it retains that fluid too powerfully to yield it to the roots of the plant, and its adhesive attraction for moisture is inconsiderable; the small quantity in which it is used likewise is a circumstance hostile to this idea.

It has been said that gypsum assists the putrefaction of animal substances, and the decomposition of manure. I have tried some experiments on this subject, which are contradictory to the notion. I mixed some minced veal with

with about one-one hundredth part of its weight of gypsum, and exposed some veal without gypsum under the same circumstances; there was no difference in the time in which they began to putrefy, and the process seemed to me most rapid in the case in which there was no gypsum present. I made other similar mixtures, employing in some cases larger, and in some cases smaller, quantities of gypsum; and I used pigeons' dung in one instance instead of flesh, and with precisely similar results. It certainly in no case increased the rapidity of putrefaction.

Though it is not generally known, yet a series of experiments has been carried on for a great length of time in this country upon the operation of gypsum as a manure. The Berkshire and the Wiltshire peat-ashes contain a considerable portion of this substance. In the Newbury peat-ashes I have found from one-fourth to one-third of gypsum, and a larger quantity in some peat-ashes from the neighbourhood of Stockbridge: the other constituents of these ashes are calcareous, aluminous, and siliceous earth, with variable quantities of sulphate of potassa, a little common salt, and sometimes oxyd of iron. The red ashes contain most of this last substance.

These peat-ashes are used as a top dressing for cultivated grasses, particularly sainfoin and clover. In examining the ashes of sainfoin, clover, and rye grass, I found that they afforded considerable quantities of gypsum; and this substance, probably, is intimately combined as a necessary part of their woody fibre. If this be allowed, it is easy to explain the reason why it operates in such small quantities; for the whole of a clover crop, or sainfoin crop, on an acre, according to my estimation, would afford by incineration only three or four bushels of gypsum. In examining the soil in a field near

Newbury,

Newbury, which was taken from below a foot-path near the gate, where gypsum could not have been artificially furnished, I could not detect any of this substance in it; and at the very time I collected the soil the peat-ashes were applied to the clover in the field. The reason why gypsum is not generally efficacious is probably because most cultivated soils contain it in sufficient quantities for the use of the grasses. In the common course of cultivation gypsum is furnished in the manure; for it is contained in stable dung, and in the dung of all cattle fed on grass; and it is not taken up in corn crops, or crops of peas and beans, and in very small quantities in turnip crops; but where lands are exclusively devoted to pasturage and hay it will be continually consumed. I have examined four different soils cultivated by a series of common courses of crops for gypsum. One was a light sand from Norfolk; another, a clay, bearing a good wheat, from Middlesex; the third a sand, from Sussex; the fourth a clay, from Essex. I found gypsum in all of them; and in the Middlesex soil it amounted nearly to one *per cent.* Lord Dundas informs me, that having tried gypsum without any benefit on two of his estates in Yorkshire, he was induced to have the soil examined for gypsum, and this substance was found in both the soils.

Should these statements be confirmed by future inquiries, a practical inference of some value may be derived from them. It is possible that lands which have ceased to bear good crops of clover, or artificial grasses, may be restored by being manured with gypsum. I have mentioned that this substance is found in Oxfordshire; it is likewise abundant in many other parts of England; in Gloucestershire, Somersetshire, Derbyshire, Yorkshire, &c. and requires only pulverisation for its preparation.

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Some very interesting documents upon the use of sulphate of iron or green vitriol, which is a salt produced from peat in Bedfordshire, have been laid before the Board by Dr. Pearson: and I have witnessed the fertilising effects of a ferruginous water used for irrigating a grass meadow made by the Duke of Manchester at Priestley Bog, near Woburn, an account of the produce of which has been published by the Board of Agriculture. I have no doubt that the peat salt and the vitriolic water acted chiefly by producing gypsum.

The soils on which both are efficacious are calcareous; and sulphate of iron is decomposed by the carbonate of lime in such soils. The sulphate of iron consists of sulphuric acid and oxyd of iron, and is an acid and a very soluble salt; when a solution of it is mixed with carbonate of lime the sulphuric acid quits the oxyd of iron to unite to the lime, and the compounds produced are insipid, and comparatively insoluble.

I collected some of the deposition from the ferruginous water on the soil in Priestley meadow. I found it consisted of gypsum, carbonate of iron, and insoluble sulphate of iron. The principal grasses in Priestley meadow are, meadow fox-tail, cock's-foot, meadow fescue, fiorin, and sweet-scented vernal grass. I have examined the ashes of three of these grasses, meadow fox-tail, cock's-foot, and fiorin. They contained a considerable proportion of gypsum.

Vitriolic impregnations in soils, where there is no calcareous matter, as in a soil from Lincolnshire, are injurious; but it is probably in consequence of their supplying an excess of ferruginous matter to the sap. Oxyd of iron in small quantities forms an useful part of soils; and it is found in the ashes of plants, and probably is hurtful only in its acid combinations.

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I have just mentioned certain peats, the ashes of which afford gypsum; but it must not be inferred from this, that all peats agree with them. I have examined various peat-ashes from Scotland, Ireland, Wales, and the Northern and Western parts of England, which contained no quantity that could be useful; and these ashes abounded in silicious, aluminous earths, and oxyd of iron.

Lord Charleville found in some peat-ashes from Ireland sulphate of potassa, *i. e.* the sulphuric acid combined with potassa.

Vitriolic matter is usually formed in peats; and if the soil or substratum is calcareous, the ultimate result is the production of gypsum. In general, when a recent peat-ash emits a strong smell, resembling that of rotten eggs when acted upon by vinegar, it will furnish gypsum.

Phosphate of lime is a combination of phosphoric acid and lime, one portion of each. It is a compound insoluble in pure water, but soluble in water containing any acid matter. It forms the greatest part of calcined bones. It exists in most excrementitious substances, and is found both in the straw and grain of wheat, barley, oats, and rye, and likewise in beans, peas, and tares. It exists in some places in these islands native, but only in very small quantities. Phosphate of lime is generally conveyed to the land in the composition of other manure, and it is probably necessary to corn crops and other white crops.

Bone ashes ground to powder will probably be found useful on arable lands containing much vegetable matter, and may perhaps enable soft peats to produce wheat; but the powdered bone in an uncalcined state is much to be preferred in all cases when it can be procured.

The *saline compounds of magnesia* will require very little discussion as to their uses as manures. The most important

portant relations of this subject to agriculture have been considered in the former part of this Lecture, when the application of the magnesian limestone was examined. In combination with sulphuric acid magnesia forms a soluble salt. This substance, it is stated by some inquirers, has been found of use as a manure; but it is not found in nature in sufficient abundance, nor is it capable of being made artificially sufficiently cheap to be of useful application in the common course of husbandry.

Wood ashes consist principally of the vegetable alkali united to carbonic acid; and as this alkali is found in almost all plants, it is not difficult to conceive that it may form an essential part of their organs. The general tendency of the alkalies is to give solubility to vegetable matters; and in this way they may render carbonaceous and other substances capable of being taken up by the tubes in the radicle fibres of plants. The vegetable alkali likewise has a strong attraction for water, and even in small quantities may tend to give a due degree of moisture to the soil, or to other manures; though this operation, from the small quantities used, or existing in the soil, can be only of a secondary kind.

The *mineral alkali,* or *soda,* is found in the ashes of sea-weed, and may be procured by certain chemical agencies from *common salt.* Common salt consists of the metal named sodium, combined with chlorine; and pure soda consists of the same metal united to oxygen. When water is present, which can afford oxygen to the sodium, soda may be obtained in several modes from salt.

The same reasoning will apply to the operation of the pure mineral alkali, or the carbonated alkali, as to that of the vegetable alkali; and when common salt acts as a manure, it is probably by entering into the composition of the plant in the same manner as gypsum, phos-

phate

phate of lime, and the alkalies. Sir John Pringle has stated, that salt in small quantities assists the decomposition of animal and vegetable matter. This circumstance may render it useful in certain soils. Common salt likewise is offensive to insects.—That in small quantities it is sometimes a useful manure, I believe is fully proved; and it is probable that its efficacy depends upon many combined causes.

Some persons have argued against the employment of salt; because when used in large quantities, it either does no good, or renders the ground sterile; but this is a very unfair mode of reasoning. That salt in large quantities rendered land barren, was known long before any records of agricultural science existed. We read in the Scriptures, that Abimelech took the city of Schechem, "and beat down the city, and sowed it with salt," that the soil might be for ever unfruitful. Virgil reprobates a salt soil; and Pliny, though he recommends giving salt to cattle, yet affirms, that when strewed over land it renders it barren. But these are not arguments against a proper application of it. Refuse salt in Cornwall, which, however, likewise contains some of the oil and exuviæ of fish, has long been known as an admirable manure. And the Cheshire farmers contend for the benefit of the peculiar produce of their country.

It is not unlikely that the same causes influence the effects of salt as those which act in modifying the operation of gypsum. Most lands in this island, particularly those near the sea, probably contain a sufficient quantity of salt for all the purposes of vegetation; and in such cases the supply of it to the soil will not only be useless, but may be injurious. In great storms the spray of the sea has been carried more than fifty miles from the shore; so that from this source salt must be often supplied to the

soil. I have found salt in all the sandstone rocks that I have examined, and it must exist in the soil derived from these rocks. It is a constituent likewise of almost every kind of animal and vegetable manure.

Besides these compounds of the alkaline earths and alkalies, many others have been recommended for the purposes of increasing vegetation; such are *nitre*, or the nitrous acid combined with potassa. Sir Kenelm Digby states, that he made barley grow very luxuriantly by watering it with a very weak solution of nitre; but he is too speculative a writer to awaken confidence in his results. This substance consists of one proportion of azote, six of oxygen, and one of potassium; and it is not unlikely that it may furnish azote to form albumen, or gluten, in those plants that contain them; but the nitrous salts are too valuable for other purposes to be used as manures.

Dr. Home states, that *sulphate of potassa*, which, as I just now mentioned, is found in the ashes of some peats, is a useful manure. But Mr. Naismith * questions his results; and quotes experiments hostile to his opinion, and, as he conceives, unfavourable to the efficacy of any species of saline manure.

Much of the discordance of the evidence relating to the efficacy of saline substances depends upon the circumstance of their having been used in different proportions, and in general in quantities much too large.

I made a number of experiments in May and June 1807, on the effects of different saline substances on barley and on grass growing in the same garden, the soil of which was a light sand, of which 100 parts were composed of 60 parts of siliceous sand, and 24 parts finely divided matter, consisting of seven parts carbonate of lime,

* Elements of Agriculture, p. 78.

twelve

twelve parts alumina and silica, less than one part saline matter, principally common salt, with a trace of gypsum and sulphate of magnesia: the remaining sixteen parts were vegetable matter.

The solutions of the saline substances were used twice a week, in the quantity of two ounces, on spots of grass and corn, sufficiently remote from each other to prevent any interference of results. The substances tried were *super-carbonate, sulphate, acetate, nitrate,* and *muriate of potassa; sulphate of soda, sulphate, nitrate, muriate,* and *carbonate of ammonia.* I found, that in all cases when the quantity of the salt equalled one-thirtieth part of the weight of the water, the effects were injurious; but least so in the instances of the carbonate, sulphate, and muriate of ammonia. When the quantities of the salts were one-three hundredth part of the solution, the effects were different. The plants watered with the solutions of the sulphates grew just in the same manner as similar plants watered with rain water. Those acted on by the solution of nitre, acetate, and super-carbonate of potassa, and muriate of ammonia, grew rather better. Those treated with the solution of carbonate of ammonia grew most luxuriantly of all. This last result is what might be expected, for carbonate of ammonia consists of carbon, hydrogen, azote, and oxygen. There was, however, another result, which I had not anticipated; the plants watered with solution of nitrate of ammonia did not grow better than those watered with rain water. The solution reddened litmus paper; and probably the free acid exerted a prejudicial effect, and interfered with the result.

Soot, doubtless, owes part of its efficacy to the ammoniacal salts it contains. The liquor produced by the distillation of coal contains carbonate and acetate of ammonia, and is said to be a very good manure.

In

In 1808 I found the growth of wheat in a field at Roehampton assisted by a very weak solution of acetate of ammonia.

Soapers' waste has been recommended as a manure, and it has been supposed that its efficacy depended upon the different saline matters it contains; but their quantity is very minute indeed, and its principal ingredients are mild lime and quick-lime. In the soapers' waste, from the best manufactories, there is scarcely a trace of alkali. Lime moistened with sea water affords more of this substance, and is said to have been used in some cases with more benefit than common lime.

It is unnecessary to discuss to any greater extent the effects of saline substances on vegetation; except the ammoniacal compounds, or the compounds containing nitric, acetic, and carbonic acid, none of them can afford by their decomposition any of the common principles of vegetation, carbon, hydrogen, and oxygen.

The alkaline sulphates and the earthy muriates are so seldom found in plants, or are found in such minute quantities, that it can never be an object to apply them to the soil. It was stated in the beginning of this Lecture, that the earthy and alkaline substances seem never to be formed in vegetation; and there is every reason likewise to believe, that they are never decomposed; for after being absorbed they are found in their ashes.

The metallic bases of them cannot exist in contact with aqueous fluids; and these metallic bases, like other metals, have not as yet been resolved into any other forms of matter by artificial processes; they combine readily with other elements; but they remain undestructible, and can be traced undiminished in quantity, through their diversified combinations.

Portable

Portable Corn Mill for Family Use. By Mr. Charles Williams, *of Hatfield-street, Blackfriars Road.*

With a Wood Engraving.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The Silver Medal and Twenty Guineas were voted to Mr. Williams *for this Communication.*

Having had various applications for hand corn mills, and being convinced that nothing but stones are calculated to grind wheat, and that in every mode which has hitherto been adopted they have always been attended with great expenses, and occupied much room, I beg leave to submit to the Society a mill, in which I have endeavoured to obviate the above inconveniences. It is composed of a pair of French burr-stones, working vertically; the running stone works against a fixed breast, which is occasionally moved to adjust the fineness of the flour by means of a regulating screw. The mill is intended to be fixed by three bolts to a post. The simplicity of its construction, the small space it occupies, and the manner of its performance, combined with its cheapness, I trust will be a sufficient recommendation of it to merit the approbation of the Society.

With this mill a man may grind half a bushel of wheat in an hour. I can now manufacture them for twelve guineas each, and have no doubt of being able to make them much cheaper.

Reference to the Engraving.

A, Fig. 2, the running-stone, constructed of French Burr, having also a fly-wheel and a pinion upon the same axle with it, placed outside the cheeks of the frame.

J,

I, Fig. 1, shews the small pinion on the same axle with the stone A and the fly-wheel.

J the multiplying wheel, turning the pinion I, and thereby increasing the velocity of the stone.

K the handle, in order to apply the power.

B, Fig. 2, the moveable breast, constructed also of French burr, made to fit the running stone on one side, and cased on the other three sides with cast-iron.

C a screw to regulate the fineness of the meal, turning in a bed shewn separately at R and M, Fig. 3. The side of the iron case which receives the screw has a female or hollow screw to receive the screw at the end of Q; by this means the whole of the case is moved in a horizontal position, so that the burr-stone breast may be brought nearer to or more remote from the cylindric running stone at pleasure. For this purpose the cast-iron case slides upon ledges cast on the insides of the two cheeks, which support the stone and wheel work.

D, Fig. 2, the screw to adjust the feed-plate, turning in a notch or bed, on the top of the moveable breast.

E, Fig. 1, the feed-plate, in which the screw works, in the same manner as C, Fig. 2, turning upon the bolt R S, as an axis.

F the hopper.

H the post to which the mill is fixed.

L, Fig. 2, the brush to keep the stone from clogging.

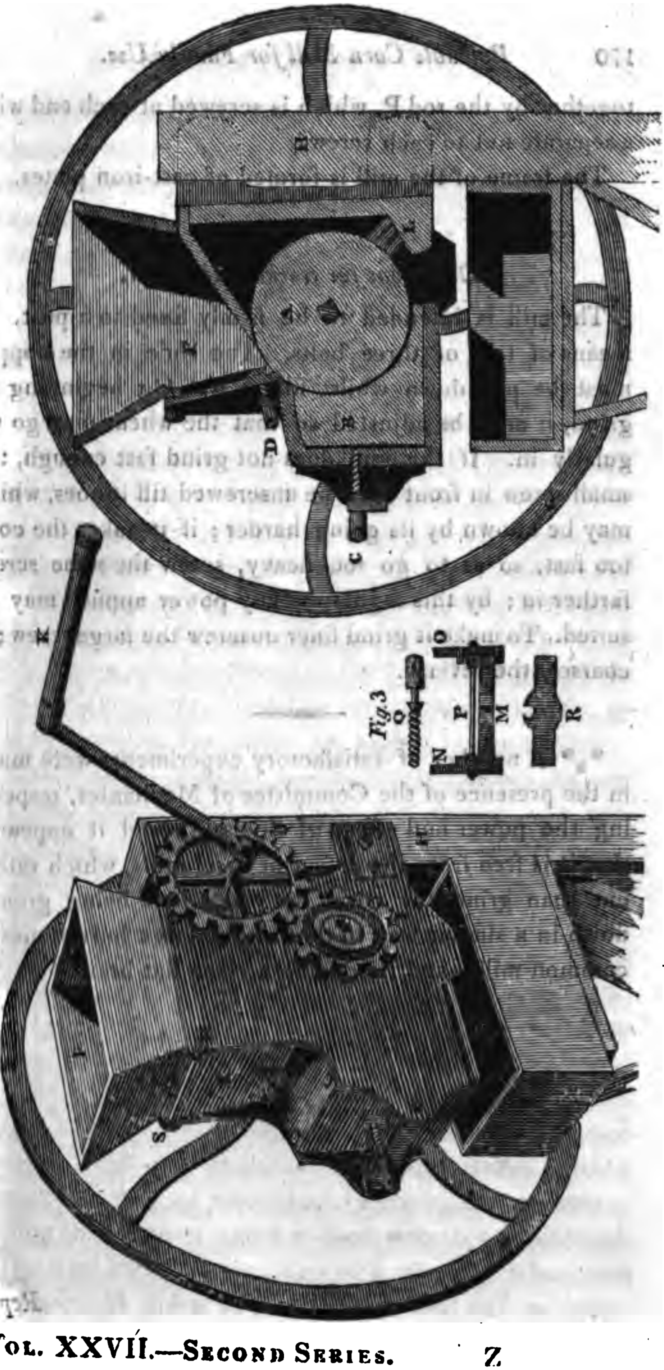
In Fig. 3 Q represents the screw, with a hole through its head, to receive a lever for the purpose of turning it round, and with a neck and shoulders upon each side of it, to turn in the semi-circular notch M of the bar R.

This bar has its ends bent at right angles, and fitted to grooves in the cheeks of the mill, parts of which are shewn at N O, so as not to shake, and the whole is bound

together

Fig. 2.

Fig. 1.



together by the rod P, which is screwed at each end with a separate nut to each screw.

The frame of the mill is formed of cast-iron plates.

Directions for working the Mill.

The mill is intended to be firmly fixed to a post, by means of two or three bolts. The slide in the hopper must be put down whilst filling it. On beginning to grind, it must be adjusted so that the wheat may go regularly in. If the mill does not grind fast enough, the small screw in front must be unscrewed till it does, which may be known by its going harder; if it takes the corn too fast, so as to go too heavy, screw the same screw farther in: by this regulation any power applied may be suited. To make it grind finer unscrew the large screw; if coarser, the reverse.

*** A number of satisfactory experiments were made in the presence of the Committee of Mechanics, respecting the power and effect of this mill; and it appeared that it is free from the defect of steel mills, which rather cut than grind the corn, the wheat here being ground down in a similar way to that of the large burr-stones in common mills, and producing a clean flat bran.

Report

Report of the Proceedings in the Court of Common Pleas respecting the Patent granted to VANUREL ZINCK, *for his Method of making British Verdigris.*

Sittings after Term, Guildhall, July 1, 1815.

WOOD and others, *v.* ZIMMERMAN.

THIS was a case of considerable importance to all Patentees. It was an issue from the Court of the Master of the Rolls to try the validity of a Patent, existing under the following circumstances:

The Plaintiffs are the assignees of Vanurel Zinck and Co. (bankrupts) who were the inventors and patentees of an article called *British Verdigris,* and the defendant is a colourman, who purchased of the plaintiffs a part of the bankrupt's property, his patent for manufacturing the article in question, for which he agreed to pay 2,500 *l.*— The defendant, however, subsequently refused to pay this sum, alleging that the patent was invalid. In support of the validity of the patent, this day, the evidence produced was, first, the specification under which the patent was obtained by the Bankrupts. From this it appeared that the *British Verdigris* was produced from certain proportions of granulated copper and oil of vitrol, boiled for a given time in a boiler of a particular construction, and afterwards mixed with a solution of *potash* or *soda.* The advantages of the *verdigris* so produced were, a brighter green than that obtained from the French *verdigris,* and its capability of being mixed with a greater quantity of white lead, whereby the expense of making the brighter green was considerably diminished.

The next evidence was that of a chemist, who, from the directions given in the specification, had manufac-

tured a *verdigris* similar to that sold by the original patentees; and, lastly, a workman who had been employed by the patentees in the manufacture of the verdigris, and who stated that the directions given in the specification were those which he followed in his labours with some slight variations.

Such was the case of the plaintiffs, and Mr. Serjeant Best, who conducted their cause, submitted that here was ample evidence of a good and valid patent, and contended that, as the Defendant had agreed to purchase it, he was bound to pay the sum sought to be recovered.

Upon the part of the Defendant the arguments were two-fold; first, that the original patentees had sold the verdigris in question, under the title of "Dutch Imperial Green," long before the patent was obtained; and, next, that all that was necessary to manufacture the article was not contained in the specification upon which the patent was obtained, and upon these grounds it was contended that the patent was void, and that the Defendant was not bound in law to pay the sum demanded.

The proofs in support of this case were the evidence of Mr. Vanurel, one of the bankrupts, who deposed that the same article which was sold under the name of *British Verdigris*, and for which the patent had been obtained, had been previously sold under the title of "Dutch Imperial Green," the ingredients of which the two articles were composed being precisely the same; and he farther deposed, that Mr. Zinck, the inventor, had purposely withheld one of the ingredients in the specification upon which the patent was procured, alledging, that "if he stated the whole the public would know the secret." This witness being called to state what the ingredient was, the name of which was kept back, said he was bound in a penalty of 2,000*l.* to a gentleman named Smith,

Smith, with whom he had entered into partnership, not to divulge it. The Court, however, said they would not suffer him to shelter himself under this shield, in a case where the interest of suitors was concerned; and he finally stated, that in addition to the articles contained in the specification, Mr. Zinck used a certain proportion of aqua fortis, which he always put into the boiler himself unknown to his workmen. The effect of this was to dissolve the copper more quickly, and produce a finer green.

To this testimony was added the evidence of a gentleman named Shenstone, who proved that he had purchased some of the British verdigris from the bankrupts long before the patent was taken out.

Sir Vicary Gibbs, in addressing the Jury, laid it down as a principle of law, that where a patentee, in obtaining his patent, had withheld, in the specification of his discovery or invention, any one article which was necessary to its completion, or to the facility of its production, or that was in any respect essential to its excellence, such a patent, so obtained, would, in point of law, be void. And again, if it should appear that the article for which the patent was obtained was publicly sold previous to the patent being taken out, such previous publicity, he apprehended, but he was liable to correction, also rendered the patent of no avail. Such was the law, in his judgment, and he left it for the Jury to find a verdict according to that law; upon the facts which had been proved.

The Jury returned a verdict—"That an article necessary to the manufacturing of the verdigris had been withheld; and that the verdigris had been sold before the patent was taken out." This verdict was on the points of law for the defendant, and the patent of course becomes void.

Report

Report by M. MOLARD *on Compasses for tracing Circles and Ellipses of a small Diameter, invented by M.* BARADELLE, *the Son.*

With an Engraving.

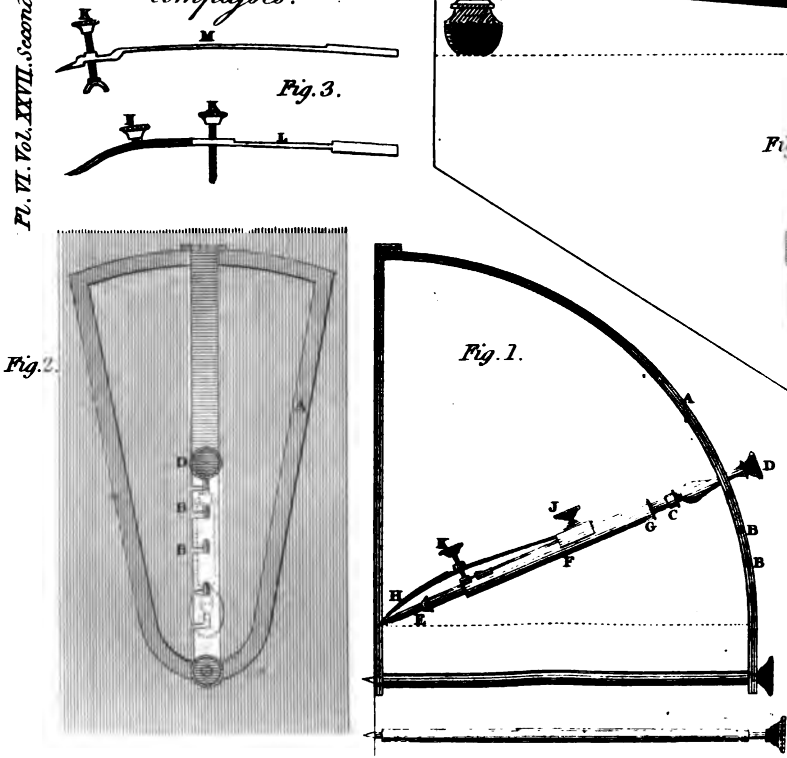
From the BULLETIN DE LA SOCIETE' D'ENCOURAGEMENT.

THESE compasses are made for one leg to turn round the other as round a fixed axis. To produce this effect, the inventor has made the immoveable leg in the form of a baluster, of which the lower and cylindrical part, which is of steel, is terminated by a point, and the upper part, which is composed of copper, ornamented with mouldings, is finished with a notched head, which facilitates the handling of the instrument; the moveable or turning branch is composed of a tube of copper, mounted on the cylindrical part of the baluster. The upper part of this tube is furnished with a circular notched edge, by which it is turned when circles or ellipses are to be traced by means of changing steel points, adapted to the side of the tube, and which are fixed there by a screw; and, as each of the changing pieces form a spring, they may, by the help of another screw, be moved nearer to or farther from the point of the fixed leg, according to the diameter of the circle to be traced.

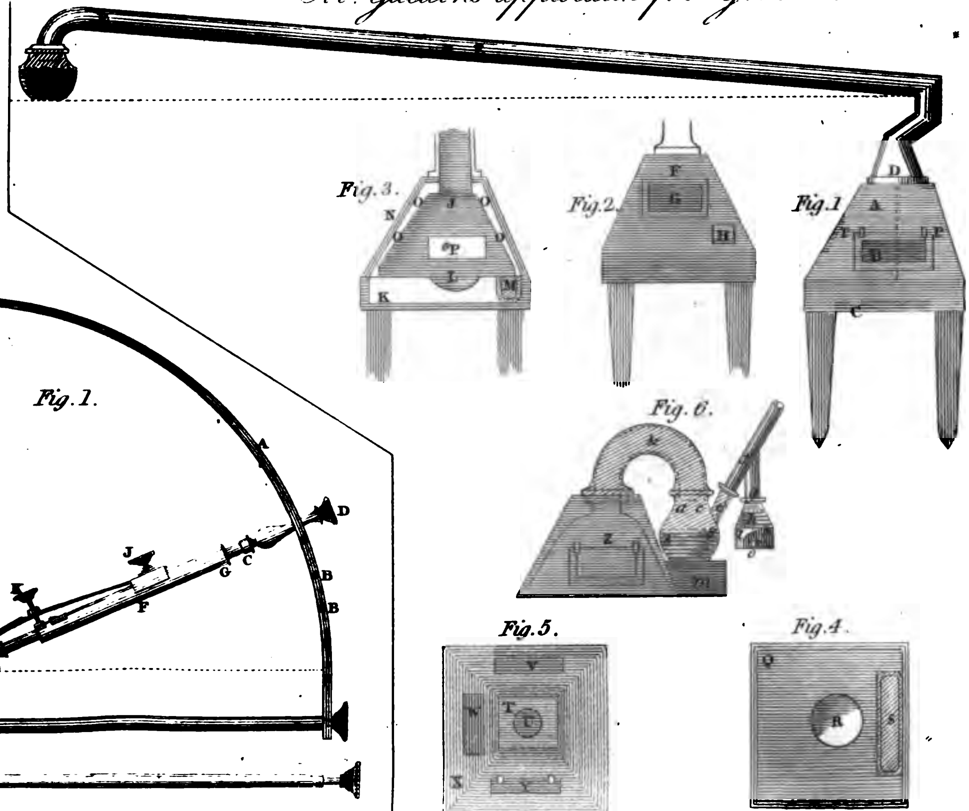
We see from this succinct explanation, that, in order to trace a perfect circle with this instrument, it is necessary that the immoveable leg be perpendicular to the plan on which it is made, for, if it be ever so little inclined, the moveable point having a tendency to mount and descend at the same time that it is turned, it traces ellipses, which are more or less elongated, in proportion

as

M. Molard's compasses.



M. Guedin's apparatus for Gilders.



as the fixed leg is more or less perpendicular; therefore, in order to trace ellipses of the same form, as well as to trace perfect circles, it is indispensable that the fixed leg be kept invariably in the position that is necessary to produce the desired effect. Yet however practised any persons may be in handling instruments of this nature, it is impossible to be certain at all times of being able to maintain the fixed leg in the desired position.

To remedy this inconvenience, the author has invented a frame *(armature)*, by which the compasses are kept in their place, and the use of them is facilitated in every way.

Fig. 1 (Plate VI.) is a view of the compasses placed in the frame, and disposed for tracing ellipses. A, the frame, composed of copper. B B, notches made to receive the fixed leg of the compasses. C, the baluster, or fixed leg of the compasses, in an inclined position. D, the notched head, which facilitates the handling of the instrument. E, the steel cylindrical point, which is fixed on the paper. F, the tube, or moveable and turning leg of the compasses, which slides freely up and down on the baluster C. G, the circular notched edge by which the moveable branch is turned. H, the changing point, adapted to the side of the tube F; it serves to make fine traces. J, the screw which fixes the point H upon the tube. K, the screw which moves the point of the moveable leg of the compasses farther from or nearer to the fixed leg, according to the diameter of the circles that are to be traced. The dotted line in this figure shews the vertical position in which the instrument is to be fixed when it is intended to trace circles.

Fig. 2, bird's-eye view of the compasses and the frame, placed on a sheet of paper. The dotted lines shew the form of the compasses.

Fig.

Fig. 3, the steel points, shewn separately. L, the point for ink. M, the point for tracing dry lines on copper. N, screw of the drawing pen, for making lines of different breadths. The same letters denote the same parts in all the figures.

Description of an Apparatus for preserving Gilders from the dangerous Effects of Mercury. By M. R. GUEDIN, *of Geneva.*

With an Engraving.

From the BULLETIN DE LA SOCIETE D'ENCOURAGEMENT.

THE method employed by the author to defend his workmen from the action of mercury vapour in the operation of gilding in *Or Moulu*, consists in the peculiar construction of the furnace, which is covered with a pyramidical head, terminated at the upper part by a pipe or chimney, sixteen feet long, and which is bent over a vessel half full of water. Glass frames are placed round the head, which serve to enlighten the interior, and permit the workman to follow the progress of the operation; he introduces the pieces by a small aperture, which he closes immediately.

The vapour of mercury condensed in the pipe as it cools, and runs into the vessel placed to receive it. M. Guedin assures us, that he has collected 40 pounds from 80 of the mercury that he has employed.

This very simple process has been used in several dangerous manipulations: it is, doubtless, susceptible of much improvement; but such as it is at present it may be of very great use in the operation to which he has been applied.

The

The Consultative Board of Arts and Trades, who were appointed to examine it, think that the author merits a reward, and recommend the sum of 500 francs to be given to encourage him to improve his apparatus.

M. Guedin has since given a description of a new apparatus, which appears to be very useful; but as it may be easily improved, and as M. D'Arcet, who is employed on a large work on the art of gilding, has promised to communicate to us some of his improvements on Guedin's furnace, we shall content ourselves in this place with giving the figure of the apparatus, as it was first made.

Fig. 1, (Pl. VI.) A, an elevation of the right side of the furnace. B, a window, which is moved by means of two hinges *p p*, and by which the fire and water are put into the furnace. C, a solid table, upon which the furnace is placed. D, a chimney, adapted to the top of the furnace, perpendicularly above the fire-place: it is prolonged by three elbow joints to the tube E E. E E, is a tube, of cast-iron or baked clay, in which the mercury condenses, and which becomes re-vivified in the earthen vessel *n*, full of water, an inch distant from the end.

Fig. 2, F, the principal front of the furnace before which the workman stands. G, the glass through which the workman observes the progress of the operation of the mercury on his work. H, an opening, four inches square, by which the workman introduces his work into the fire-place, and draws it out by means of pinchers.

Fig. 3, J, a lateral section of the furnace, with its head and lining. K, body of the furnace, four inches thick, two feet two inches and six lines square, of stone, or any other substance that resists fire. L, fire-place cut in the stone, ten inches in diameter and three inches deep. M, an earthen trough, which is filled with water to cool

 the

the interior of the head of the furnace. N, the cap of wood, which covers the furnace all over. O O, the coat of plaster adapted to the inside of the head. P, window on the left side of the cap, near the casement, where the furnace is built. It shews the work on the inside, to the workman.

Fig. 4, Q, plan of the furnace, with its covering of wood. R, the fire-place, ten inches diameter, in which is put the fire necessary to the evaporation of the mercury. S, an earthen trough, eighteen inches long, and four inches wide and deep, sunk in the body of the furnace, and on a level with the fire-place.

Fig. 5, T, plan of the top of the cap. U, circular opening, six inches in diameter, made in the top of the cap to receive the chimney. V, the window on the left side, to give light to the interior of the furnace. W, front window opposite the workman. X, square opening, by which workman introduces his work. Y, moveable window on the right side.

Fig. 6, Z, apparatus of the cap or head, with the conductor or semi-circular chimney, &c. semi-circular chimney, of brick, adapted to the preceding furnace: it was invented by the author for cases in which the situation will not allow of the construction of a chimney of sixteen feet, as at D and E. *a*, an earthen recipient, partly filled with water, in which the mercury precipitates as it re-vivifies. *b*, level of the water contained in the recipient. *c*, round hole, by which the water is introduced. *d*, another hole, two inches below the first, serving to shew the volume of water: these two holes are stopped with a cork. *e*, end of the earthen tube next to the recipient. *f*, tube of cast-iron, adapted to the earthen tube, and continued to any length out of the workshop. *g*, vent hole, placed under the tube of cast-iron, by which the steam of the water

water contained in the reservoir *h* is introduced into the tube. *h*, a copper or tinned iron reservoir, filled with warm water, and which is joined to, and hooks on to, the vent hole. *i*, the furnace, placed in the reservoir; the heat of which is kept up by a lamp, and causes the steam to mount into the tube. *m*, a block, placed behind the head of the furnace, to support the recipient. *o*, the lamp which is placed within the furnace.

N. B. To preserve the health of the workmen, they must not be allowed to beat the pieces while they are hot; but they must wait until the evaporation of the mercury is completed under the head, and not draw them out to beat them until they are only warm.

Description of a Process for dyeing Silk of a Prussian Blue, so as to give it an uniform, firm, and bright Colour. By M. RAYMOND.

(Concluded from Page 119.)

THIRD OPERATION.

WHEN the silk has imbibed a sufficient proportion of the iron mordant, and has been well washed and squeezed with the hand only, a quantity of water is to be heated in a boiler, until it has acquired the temperature of 60 degrees of Reaumur's thermometer. A deal vessel must then be made three parts full with this water (metal vessels not being proper for this operation) and one part of prussiate of potash, well crystallised, melted in it, for twelve parts of silk prepared for receiving a dye of prussian blue, of a deep shade, such as is called *bleu de roi*. When the prussiate is entirely dissolved, add one part, and even rather more, of muriatic acid, at about twenty-one or twenty-two degrees of Beaumé's aëreometer, being

 careful

careful to stir the bath well, in order to render more expeditious and complete the decomposition of the alkaline prussiate. When the liquor has acquired a greenish colour the silk must be immediately plunged in it, and stirred about for some minutes, after it has been well wrung and disposed upon poles, in the same manner as for the iron mordant.

The silk having received in an equal manner the dye of prussian blue, it is taken out of the vat of prussiate, and after being well squeezed, by wringing on a pole over the vat, in order that none of the solution of prussiate may be lost, it is taken to the river, where it must receive two or three beetlings, and must be plunged and agitated each time in the water, (in the same manner as for dyeing black,) in order to free it entirely from any portion of prussiate of iron that is not truly combined in it, and which, by remaining partly interposed in the silk, would cause it to dye the water blue, and also to produce stains of blue on any white body by which it is rubbed.

Observations relative to the Third Operation.

1st. Prevent, with the most scrupulous attention, the wet silk that is just dyed of a prussian blue from coming in immediate contact with oxyds, and still more with solutions of iron, for any part that happens to be touched by them would immediately become of a greenish colour, which may be restored to the blue by dipping it again in a solution of prussiate.

2d. The degree of temperature which has appeared to me to be most suitable for this dye, so that the colour may acquire all the brilliancy and intensity of which it is susceptible, is 50 degrees Reaumur. Nevertheless, I have recommended the water to be heated to 60 degrees, because

because it loses about ten degrees, probably either in its passage from the boiler to the vat, or by the immersion of the silk in it which is to be dyed by means of prussiate of potash. A degree of heat, much below 50, would render the colour dull, and the combination of the prussic acid with the oxyd of iron being barely effected, it would result that the colour would not be so well fixed, and the lengths of silk would not be so easily separated from each other, as when the temperature employed has been from 50 to 60 degrees.

3d. The silk that is to be passed through the vat of prussiate should be well wrung with the hands before it is placed on the poles; if it is too wet it will cool the bath too much; if too dry it will be very slow in imbibing the prussiate solution, and consequently the operation of dyeing it of a perfectly uniform colour will be much lengthened.

4th. The proportions of prussiate of potash and muriatic acid that I have prescribed are those which my numerous experiments have shewn me to be the most advantageous; and, I must observe, that the requisite quantities in this case have such an influence, that if they are not adhered to, the operation cannot be expected to succeed. Perhaps it may be useful to give in this place the manner in which I was led to the discovery of the proportions.

Having filled some silk with as much as it could possibly contain of the mordant of oxyd of iron, and afterwards, when it was well cleansed, passed it through a bath of prussiate of potash and muriatic acid, being persuaded that I was going to obtain a rich and deep blue shade, I was much surprised to find that the silk took only greenish blue tint, which was poor, and without firmness; thinking then that I had not dissolved in the

water

water a sufficient quantity of prussiate of potash to saturate with prussic acid all the oxyd of iron with which I had taken care to fill the silk, I believed I could not do better than to put a fresh quantity into the bath, after the silk was out of it, which I again dipped in as soon as the fresh portion of prussiate added was dissolved, and that I had poured in the quantity of muriatic acid requisite to effect the decomposition, and to facilitate by that means the combination of the prussic acid with the oxyd of iron; and I own that my astonishment was extreme, to see that the silk, instead of becoming strongly coloured with blue, lost on the contrary a part of its first colour, at the same time that the bath became of an exceedingly deep blue, by reason of the great quantity of particles of prussiate of iron which floated in it. Recollecting at this instant the property discovered by M. Berthollet, in gallic acid, of dissolving gallate of iron, I thought that the prussic acid might possibly possess the same power, with respect to the prussiate of the same metal; and that this was doubtless the cause that a portion of prussiate of iron which at first fixed on the silk, was afterwards detached from it, when I dipped it the second time into the liquor to which I had added a fresh quantity of prussiate of potash and muriatic acid, which set free a quantity of prussic acid much exceeding what was necessary for the entire saturation of the oxyd of iron fixed in the silk, and which exceeding portion served only to dissolve and take out of it a part of the prussian blue that was already fixed in it.

Being desirous to confirm this reasoning by experiment, I again saturated the silk as much as possible with oxyd of iron, leaving it for this purpose immersed for several hours in the same solution that I had before used. When the silk had been carefully cleansed in the river, I passed

passed it through a bath of warm water, into which I at first put but a very small quantity of prussiate of potash and muriatic acid, which I took care to augment progressively as long as I perceived that the blue colour acquired intensity: I obtained by this means, and with an infinitely small quantity of prussiate of potash, a shade of blue, much richer and more firm than I could obtain before. The liquor did not become blue, but remained constantly of a greenish cast, and perfectly transparent, both being indications that the proportions were nearly what they ought to be to insure the success of the operation; for I afterwards discovered that every time the bath of prussiate of potash became of a blue colour when the silk was dipped in it, it was an indication that it contained either too much prussiate or muriatic acid, or that the silk, after passing through the mordant of oxyd of iron, had not been sufficiently cleansed in the river.

It is not enough, therefore, according to what I have related, that the iron (as M. Proust has said) be carried to a great state of oxydation, in order to produce a deep blue by its combination with prussic acid; but it is also necessary that it should not meet with more than the quantity requisite to saturate it, otherwise the colour produced by the new combination is rather green than truly blue, of which we may be satisfied by pouring a great quantity of prussiate of potash into a small quantity of a solution of super-oxydated iron; the precipitate thus obtained will be of a greenish blue, but on adding more of the same solution of iron it will be seen immediately to assume a deep blue colour.

5th. I recommend (operation 3d.) that the silk be well cleansed in the river with two beetlings at least, after it has passed through the bath of prussiate, and I have reason to insist on this manipulation, which takes

up

up but little time, because it appears to me to contribute much to the goodness of the colour, by freeing the portion of prussiate of iron that is combined with the silk from all that is not combined with it; and likewise on the practice of washing the silk until no more colour comes out into the water, without which this prolonged washing will sensibly lower the tone of the colour which shews itself in proportion as it is cleared from the portion of prussian blue, which, being interposed on the silk, renders it dull.

Fourth, and last, Operation.

The silk being well washed in the stream, and thoroughly wrung with the hands, it is to be placed loosely on the poles, as in the preceding operations; after which it must be well stirred and agitated in a large vessel, made three parts full of cold water, and to which must be added, for a hundred pounds of silk, two pounds of ammonia (volatile alkali), marking twenty-one degrees of the aërometer for proving spirituous liquors: the blue colour will immediately become, as if by enchantment, three shades deeper at the least, taking a much richer and brighter tint, at the same time fixing more perfectly in the silk. When this change, which is one of the most wonderful that the art produces, is effected uniformly in all the silk, and it does not take up more than two or three minutes, unless very large quantities are operated upon, for then a little more time must be employed, the silk must be taken out of the bath of ammonia, which should still preserve a slight smell of alkali, in order that we may be certain that the change has been uniformly effected in all parts of the silk; it must be wrung with the hand, and then rinced in running water, without beating; after which it must be dried in the air upon poles, in the same manner

manner as other dyed silks. It need only be left out on the poles for twenty hours, to give the colour time to come out well; for I have observed that this colour, far from being lost and faded in the drying, as is the case with most other colours, is improved, and acquires a greater richness of tint.

Observations relative to the Fourth, and last, Operation.

The idea of dipping the silk in a weak solution of ammonia, after it has been dyed Prussian blue, and well washed, in order to improve and deepen the colour, did not occur to me from reasoning, since it is well known, from *Macquer*, that alkalies will decolour Prussian blue, by taking from the oxyd of iron the prussic acid, which is the cause of its blue colour; it was only a fortunate chance that could lead me to this beautiful result; and which happened in the following manner: desiring, for economical reasons, to discharge the colour from some silk which I had badly dyed in Prussian blue, in order to dye it again the same colour by a different process, I passed it for this purpose through a boiling soap ley, to which I had added a very small quantity of crystallised carbonate of soda, in order to facilitate the separation of the prussic acid from the oxyd of iron.

I perceived that the instant I dipped the silk into this bath the blue became so exceedingly deep that it appeared to become all at once entirely black; but the next moment all the blue colour came out of the silk, and it retained only the oxyd of iron, which was so greatly oxydated that the silk took a deep buff colour.

Although it was impossible for me to explain by theory this super-oxydation of the iron, occasioned by its contact with soap and an alkali dissolved, the fact did not

appear to be the less certain; and I must say, on this occasion, that if it was equally true that the beauty and richness of the Prussian blue colour was owing to the great oxygenation of the iron, which, united with the prussic acid, I had reason to expect a very beautiful result, since I had a method of procuring at once to this metal, when fixed in the silk, all the oxygen necessary to its entire saturation. In consequence I endeavoured to produce this super-oxydation of the iron without separating from it but as little as possible of the prussic acid, by putting, for this purpose, into a solution of soap in the cold, some silk, which I had just dyed of a prussian blue. I remarked that the colour became considerably deeper, taking a richer blue tone, more decided and handsome. I repeated the experiment with some carbonate of soda, dissolved in a considerable quantity of water, and perceived that the colour became still deeper than with the soap; but I thought it came out rather dull: recollecting the utility of ammonia in effecting a change in several colours, and the admirable property of this alkali of giving brighness to the silk without hurting its texture, I dipped into some water, to which I had added some drops of ammonia, a portion of the same silk dyed Prussian blue, and, to my great satisfaction, it came out of the liquor of an extremely deep blue, which left nothing to be desired in point of brilliancy, richness, and firmness.

This last method of deepening the colour I would recommend in preference to any other; nevertheless, without any inconvenience, it may be associated in some cases with the solution of soap in the cold, to which is added a sufficient quantity of volatile alkali to effect the change completely: thus a blue colour is obtained, which red-

dens

dens a little less than when the alkali is employed alone, and which affords even an extremely-rich and handsome dye. The soap has farther the advantage of giving softness to the silk; and of rendering it more easy to separate. I found that, without any danger of hurting the colour, a pound of white soap may be employed for twenty-five pounds of silk, by dipping the silk into the solution of soap after it is quite cold; only the greatest care must be taken that the soap be quite dissolved in the water, for if there are any lumps left they will not fail to attract the colour to the portions of silk in which they lodge.

Theory of the Change effected in Prussian Blue by means of Alkalies.

It appears to be unquestionable, that alkalies, and especially ammonia, have the singular property of determining, in the oxyd of iron which fixes in the silk, the combination of a new quantity of oxygen with this metal, by bringing it at once to its maximum of oxygenation; it is even certain that the prussic acid which combines with the oxyd of iron in silk which has been dyed a Prussian blue by the ordinary processes, has no sort of influence on this extreme oxydation of the iron, by the contact of the alkalies, since it is the fact, that silk which has only passed through the iron mordant, and is, after being well washed in running water, dipped into ammonia, or any other alkali diluted with water, immediately takes the same deep red nankeen colour as it would have if, after it has been dyed a Prussian blue, it were to be soaked and boiled in a soap ley, to which a little alkali has been added, or only in a solution of this last.

How then, in similar circumstances, is this superoxydation of iron effected by the contact with soap and

with alkalies? What is the species of affinity which determines it; and which of the substances employed is it that yields the oxygen necessary to this great degree of oxydation? I own that the solution of all these questions is above my weak conception, and I leave to more able chemists than myself the task of unravelling the true theory. Yet I believe myself warranted to say, that the deep blue which is acquired by the prussiate of iron that is fixed in the silk the instant it is dipped into water, alkalised by ammonia, does not depend only on the greater degree of oxydation which appears to be effected in a similar case in the iron, without our knowing how it is effected; but I have discovered that this effect is to be also attributed to the property of the alkali, of dissolving and taking from the oxyd of iron a small portion of the prussic acid which saturates it, thus changing it to the state of prussiate of iron with excess of oxyd, which has led me to admit of two varieties of ferruginous prussiate, the one neuter, or without an excess of oxyd of iron, of a greenish blue colour, and in which the metal is not entirely oxydated; it is this prussiate which is fixed in the silk before it is dipped into the alkali; the other, not saturated with prussic acid, or, in other words, with excess of oxyd of iron at the *maximum* of oxygenation, of a blue colour, extremely rich and deep, perfectly insoluble in water, and adhering so fast to the silk, that neither water nor friction can separate them; it is this which exists in the silk, when, after it has been dyed a Prussian blue, it is passed through water slightly alkalised.

This theory is founded on the following experiment, which it is easy to repeat. If we pour upon a small quantity of a solution of sulphate of iron a great quantity of prussic acid, or prussiate of potash, we shall obtain a

precipitate

precipitate of Prussian blue, the colour of which will be more green than blue; if, on the contrary, a little prussic acid be poured upon much of a solution of the same sulphate, the precipitate in this case will be of a much more decided blue. This confirms what I have already had occasion to state in my observations on dipping the silk which has been passed through the iron mordant into the bath of prussiate, namely, that in order to obtain a good full blue, it is necessary to avoid employing too great a quantity of the prussiate, and that an excess of prussic acid will occasion the inconvenience of dissolving a portion of the Prussian blue that is fixed in the silk, because, as I have just said, it requires but a small quantity of prussic acid for a great quantity of oxyd of iron, when we wish that the combination of prussiate of iron may produce and preserve a very fine deep blue.

The different operations that I have here described for dyeing silk is equally applicable to wool, which will receive by the same process a perfectly uniform and full blue, which will resist both air and moisture. It is only necessary that it should remain longer in the iron mordant, because this metal has less affinity for wool than for silk. I must also mention, that wool being more porous than silk, it is more difficult to free it completely from the portion of sulphate of iron which remains in it when it comes out of the solution of this metal. The same difficulty occurs, after it has received the dye of Prussian blue by passing through the bath of prussiate, on washing it in a running water, to take out the portion of prussiate of iron which remains in its pores, that only that which is actually combined may remain. There is much trouble im making it succeed; and it is doubtless for these two reasons, that when wool is dyed of a Prussian

sian blue by my process; although it suffers no alteration from water, especially after drying, it evidently loses its colour by hard rubbing. I have no doubt that this inconvenience might be removed, by thoroughly cleansing the wool, by milling, after it has been in the iron mordant, as well as after it comes out of the prussiate.

I have also remarked, that wool which has been manufactured into cloth takes this dye better than when it is only in the state of yarn; the colour penetrates to the heart of the stuff, when the mordant has perfectly saturated it. I have obtained by my process the *bleu de roi* upon specimens of coarse cloth.

List of Patents for Inventions, &c.

(Continued from Page 128.)

Samuel John Smith, of Graythorn, Manchester, in the county of Lancaster, Dyer; for a method of staining, printing, or dyeing, on silk, woollen, cotton yarn, or goods manufactured of cotton. Dated June 24, 1815.

Sir William Congreve, Bart. of Parliament-street, in the city of Westminster and county of Middlesex; for a mode of manufacturing gunpowder. Dated July 3, 1815.

William Beavan the younger, of Morriston, in the county of Glamorgan, Gentleman, and Martin Beavan, of Riscor, near Newport, in the county of Monmouth, Gentleman; for certain improvements in the construction of furnaces, and their contingent apparatus for the purpose of smelting copper and other ores, and the making of copper and other metals. Dated July 12, 1815.

Charles

Charles Coldridge, of the city of Exeter, Ironmonger; for a grate and apparatus. Dated July 15, 1815.

William Lewis, of Brimscomb, in the county of Gloucester, Dyer; for an improved principle of erecting racks for the purpose of racking woollen cloth and other articles. Dated July 18, 1815.

Robert Copland, of Liverpool, in the county of Lancaster, Merchant; for means of effecting a saving in the consumption of fuel. Dated July 21, 1815.

John Manton, of Dover-street, Piccadilly, in the county of Middlesex, Gun-maker; for an improvement in the construction of hammers and pans to the locks of all kinds of fowling pieces and fire arms. Dated July 21, 1815.

Infringement

Infringement of Patent Right.

Court of Chancery, July 20, 1815.

Lord Cochrane *v.* Smithers.

IN this case the Lord Chancellor gave judgment, without the delay of some days, as yesterday proposed by him. His Lordship stated, that on a view of the apparatus of the patent lamps in question, last night, he perceived that the plaintiff was clearly entitled to the last part of the motion of Sir Samuel Romilly, his leading counsel, namely, the trial of an action at law, to ascertain the facts and merits of the case before a jury, without giving any opinion that might prejudice the case, and accordingly directed such action to be immediately tried, in which the defendant is to take defence. What can be made of it was not now to be anticipated — but the defendant, instead of being at present enjoined, is ordered to keep a regular account of the issues and profits accruing from the invention until the final determination, for the benefit of the successful party, on the termination of this suit. As to the costs at law and in equity, the same are to abide the ultimate determination, and to be paid by the vanquished party.

An action was ordered.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CLX. SECOND SERIES. Sept. 1815.

Specification of the Patent granted to PETER MARTINEAU *the Younger, of Canonbury House, Islington, and* JOHN MARTINEAU *the Younger, of Stamford Hill, in the County of Middlesex, Gentlemen; for a new Method or Methods of refining or clarifying certain Vegetable Substances.* Dated May 8, 1815.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, we the said Peter Martineau and John Martineau do declare that the vegetable substance to which we have particularly applied this invention is sugar, or sugar more or less dissolved in water, for the purpose of clarifying or refining it, though the said invention will apply to other vegetable substances, and in particular to such vegetable acids as are usually prepared or manufactured in a crystallised state. And we declare, that if our invention, so far as relates to animal charcoal, be applied to these acids or other vegetable substances, the process to be employed should be the same as is hereafter described, excepting only, that as blood may be advantageously used in refining sugar, it is not necessary for re-

refining other substances from which the articles we employ may be separated by filtering in common and well-known methods. And we hereby declare, that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows. The articles we employ for purifying and clarifying sugar are, firstly, animal charcoal; that is to say, animal substances, properly burnt or charred, or calcined, whatever denomination the said charcoal may have obtained, as ivory black, bone, ash, &c. and afterwards reduced into smaller pieces or powder. Secondly; bituminous earths, commonly called coals, either in the state in which they are mined or articles of their products after fusion, and reduced as aforementioned. Thirdly; certain argillaceous earths, known by the name of ochres. Fourthly; the vegetable charcoal, usually called lamp-black: we, however, generally prefer the use of the first mentioned articles in the process of refining and clarifying sugar, which we find renders the sugar so clarified much whiter than by the heretofore common method of clarifying.

Now, although the manner of applying the above-mentioned substances in the refining of sugar may be greatly varied, yet the following method we prefer. We do charge or fill our boilers or pans with sugar and water, or lime water, as in the common and well known methods of refining sugar, only sometimes preferring to add a little more water or lime water than in the common mode of refining, as it generally more easily and effectually separates the animal charcoal, or other substances, from the liquid sugar. And we also add to the above sugar and water in the boiler a quantity of the substances before mentioned, in any quantity according to the quality of the sugar to be refined or clarified, though

we

we generally prefer two to five pounds of charcoal or earths before mentioned to and for every hundred weight of sugar to be clarified or refined. And, farther, we do pour into the boiler the usual finings of eggs, blood, or other albuminous matter in rather larger quantities than in the usual mode of refining, in order in some degree to coagulate and combine the animal charcoal, or other substances, with the dirt contained in the sugar. We do now well stir up and agitate the liquor in the boiler, in order that the animal charcoal, or other substances, may have the greater effect in blanching the liquor. And after the coagulated albumen has completely risen in the form of scum by the application of heat, in the usual way, we either skim it off, as in the common process, or we do pour the whole of the liquid sugar and scum into and upon the usual or any other known filtre where this clarified liquor is completely separated from the albuminous matter, as well as from the animal charcoal, or other substances employed, taking care to return back into the filtre the first runnings of the said liquor, if not quite separated from the above substance used. And, farther, we do proceed in the well-known and usual manner to evaporate, granulate, and refine, the said liquid sugar so clarified. And, farther, we do boil over and filtre our scum in the usual manner. And we do farther declare, that the sugar so clarified and refined is preferable to sugar refined in the heretofore common mode, inasmuch as it is purer and whiter. And we farther declare, that the syrups obtained by this process have not that tendency to ferment which the syrups have which are produced in the heretofore usual method.

In witness whereof, &c.

Specification of the Patent granted to THOMAS BRUNTON, *of Coopers-row, Crutched Friars, in the City of London, Merchant; for certain Improvements in the Construction, making, or manufacturing, of Ships Anchors and Windlasses, and Chain Cables or Moorings.*

Dated March 26, 1815.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Thomas Brunton do hereby declare that my said improvements in the construction, or making or manufacturing, of ships anchors and windlasses, and chain cables or moorings, are described and specified in manner following, reference being had to the drawings or figures hereunto annexed; that is to say: In manufacturing ships anchors in place of the common method of joining the arms to the shank, which is by welding, and which requires the iron to be so frequently heated as often to destroy and injure its tenacity, I make the shank in one piece, and the two arms in another piece, as follows. The piece intended for the arms is formed into shape, and of such a thickness or substance in the middle as to allow a hole to be made through the centre of the solid piece, to receive the thick end of the piece which forms the shank; and the said hole in the arm-piece is made somewhat conical, or bill-mouthed, so that no strain can separate the arms from the shank, by which means I avoid the necessity of endangering the solidity of the materials, only one heat being necessary to bring the thick end of the shank and the hole in the arm-piece into perfect contact, for I do not trust the strength of this important part of the anchor to a union effected by welding,

welding, which may, and generally is, defective, but to the impossibility of drawing a thick solid conical piece of iron through the smaller aperture of a conical opening into which it is fitted. The arms with their flukes may be made of good cast iron, taking care to allow them sufficient substance. But anchors should not only have the utmost strength which can be attained, but also be made as secure as possible against the danger of being lost by the cable or chain by which they are attached to the ship giving way. Cables made of hemp can never be rendered safe, but chain cables may. To convey correct ideas respecting my improvements in the construction of chain cables or moorings, it is necessary that I should point out and illustrate the principles which should guide the workman in his operations. These, when thoroughly understood, will not only enable him to avail himself of my improvements after the expiration of the said term, but will qualify him to detect, and consequently to avoid, those errors and mistakes in form and construction which prevail more or less in all the chains that have hitherto been employed for cables or moorings. The object to be gained is the greatest possible strength from a given quantity of materials, keeping in mind the direction in which the strain is to be borne. If the tendency of a strain applied to a link of a bad form be once properly conceived, a great step is gained towards the adoption of a good form.

Let A B, Fig. 1, (Plate VII.) represent a circular link of a chain, the substance of the iron one inch; let the outer circumference be fifteen inches; and let the inner circumference be nine inches. If receding forces be applied to the two links C and D, (shewn in section,) pulling C towards E, and D towards F: the ultimate tendency of the effort of such forces is to change the form of the circular link into

one

one which shall have round ends and parallel sides, as Fig. 2. But a very slight examination will shew, that before this can be effected the link must be destroyed, for in such a circular link the corresponding segments of the outer and inner circumferences are in the proportion of five to three, and therefore every effort to increase the distance between C and D, or, in other words, to make the parts A and B approximate, must disturb the relative position of every particle of the metal, and and operate to destroy its corpuscular attraction. Thus (in Fig. 1) the segment M N of the outer circumference being taken equal to three inches, the corresponding segment of the inner circumference will be one inch and eight-tenths of an inch. If this segment of the link is by the force of a strain to be changed from a curved to a straight form, (as in Fig. 2,) the corresponding segments of the outer and inner circumference must be brought to one length, to effect which the matter contained in three inches of the outer circumference must be compressed into one inch and eight-tenths of an inch, or the matter which now occupies only one inch and eight-tenths of an inch in the inner circumference, must be made to dilate itself to three inches without losing its cohesion, or the required compression and expansion must be divided between the two; all of which are impossible without a derangement of the relative position of every particle in the mass. To be brief, the matter in this part of the outer circumference may be conceived to present an infinite number of fulcrums over which the said receding forces, by an effort to render the curve straight, must rupture and separate the matter of the inner circumference. Nor is this the only mischief that must occur, as will appear by a consideration of what must take place where the link folds round C and D, for the larger semi-

circles

circles in Fig. 2, each containing four inches and an half (nearly) of the outer circumference, answering to two inches and seven-tenths of an inch of the inner circumference of Fig. 1, must now correspond to the semicircumference of the links C and D, which are each only one inch and an half (nearly), so that in these parts the effect produced by the action of the said forces would be the same as in the former, but reversed in its operation; that is, the matter in these parts of the inner circumference presents an infinite number of fulcrums, over which the outer circumference must be ruptured and separated by the said forces. A circular is, therefore, a bad form; but, from the foregoing, it is obvious that if the parts A and B, of the circular link Fig. 1, can be prevented from approximating each other, the evil that has been pointed out will be lessened. Suppose a stay, A G B, to be introduced for this purpose, and, as before, let receding forces be employed in the directions C E and D F, what will be the effect? The circular link will now be able to resist a greater force than before, having two points of support; but the unsupported parts between the points A C B and D will, by the effort of the said force, endeavour to assume a quadrilateral form, somewhat like Fig. 3; a change that cannot be effected without a derangement of the matter in the link, which must rupture and destroy it. Such stays as A G B (Figs. 1 and 3) have been used in chains, but such a stay only supports two opposite points in the link; and I have shewn that the tendency of receding forces, applied as before described, is to straighten, and consequently to rupture, the parts that are still left unsupported.

My said improvements in chain cables or moorings are founded on considerations drawn from the facts that have been alluded to. If a circular link, instead of being supported

ported only in the two opposite points A and B, have its opposite sides supported by a stay, embracing two considerable and opposite segments, suppose H I by the stay K L, taking care to leave such openings as shall allow sufficient play for the links to be received into it; the link will be much stronger than with such a stay as A G B; but still the link will prove to be of a bad form, for the tendency of receding forces, applied as before, would break the piece M O K C over the point C, as a fulcrum, and the piece N P L D over the point D, as a fulcrum. And, moreover, even if circular links could be made unobjectionable as to strength, they should be avoided on account of the greater weight of metal which a given length of chain would require than when formed of links of a less exceptionable form. We have seen that the tendency of receding forces applied to curved links is to draw portions of them into straight forms, and hence it follows, that twisted links of every kind should be avoided where strength is required; for such links, even if their opposite sides be supported by an interposed stay, like A G B, must, by the application of a sufficient strain, untwist themselves to become straight, and thus have the arrangement of their particles disturbed. As the tendency of forces applied as before mentioned to curved or twisted links is to convert the curves or distortions into straight positions, as above described, it follows, that links, presenting in their original construction straight parts between the points of strain, are the strongest that can be made with an equal portion of metal, and hence links with parallel sides and semi-circular ends would in every case be preferred were it not necessary to the quality of good chain that it should be able to resist lateral violence as well as a general strain, operating by stretching. Suppose that by any accident the

link

link Fig. 2 should have its ends drawn towards Y and Z, while a resisting body at X opposes its motion in the direction of the applied forces, the side of the link next to X would be bent inward; and if in such a link a stay like A G B were introduced, then the link would be solicited by the said force to assume a form somewhat like Fig. 4.

From the preceding considerations it is evident, that of all the forms and constructions that can be given to a link, that form and construction which shall be able to convert a lateral into an end strain, by yielding proper support to the opposite sides of the link, is the one that should be preferred, and of such a form and construction is the link Fig. 5, with my broad-ended stay, introduced between the sides of the link; for if this link (which presents its principal substance and all its points of resistance in the same place) be drawn towards *a* and *b*, against an obstacle C, it is apparent, from a bare inspection, that the parts *d e* and *d f*, which are supported by the parts *g e* and *g f*, must be drawn asunder before the link can give way, for the matter in *e g* and *f g* cannot be made to penetrate itself; and the two sides are compelled to retain their relative positions by my interposed broad-ended stay *h*, a cross section of which, through its middle, is shewn in Fig. 6. I need hardly add, that at the time that the stay *h* is introduced the link is wide enough to receive it, and the link being red hot at the time of its introduction, and being pressed home to the stay by a die or press, or any suitable mechanical means, takes a fast hold of it, and retains it in its place. Other ways of introducing and retaining in its place my broad-ended stay may be employed; but I have found the preceding exceedingly simple and efficacious.

On my broad-ended stays I have only farther to remark, that they should embrace the whole, or the greater portion, of the opposite curved parts of the middle of the link; and even if the middle of the link be made to form two opposite obtuse angles, the ends of the stay should not embrace much less than the proportion exhibited in Fig. 5: but in making the said ends to embrace any larger portion, provided sufficient room is left for the play of the links received into it, there will be no harm, only the chain will thereby be rendered heavier, which may sometimes, though not generally, be desirable.

For veering away cables in general, and particularly chain cables, a good windlass has long been a desideratum. My improvement in the construction of ships windlasses consists in making the same, or parts thereof, to revolve on an axis, in place of having the whole in one solid piece. The axis A B, Fig. 7, receives upon the square part C the pall ratchet D, Fig. 8, and upon the cylindrical parts E and F it receives the two pieces G and I, Fig. 8, round which the chain or cables receives one or more turns. The said pieces G and I are locked into D, or kept out of geer at pleasure by the checks or stops *a a a*, Figs. 8 and 9, and the counter checks or stops *b b b b*, Figs. 8, 10, and 11, or by any other means; and when out of geer they are kept asunder by any proper formed prohibitor let down between them, as the piece Fig. 12.

The advantage of this construction is simply this: in veering away the cable or chain, the pieces G and I having power to revolve on their axis, the friction and consequent wear and injury of the cable or chain, which is inseparable from the usual method of allowing the same to be rubbed in their whole course against a stationary windlass, is entirely avoided. The construction just de-

scribed

scribed has also this advantage, that the motion of the pieces G and I may be regulated by the contrivance called a break, and which being in common use for regulating velocities by means of friction, needs no description.

In witness whereof, &c.

Specification of the Patent granted to WILLIAM BUSH *the Younger, of Saffron Walden, in the County of Essex, Surveyor and Builder; for a Method of preventing Accidents from Horses falling with two-wheel Carriages, especially on steep Declivities, superior to any hitherto known or in use.* Dated April 29, 1815.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Bush do declare that my said method for preventing accidents from horses falling with two-wheel carriages, especially on steep declivities, is particularly specified in the following description of the apparatus which I attach to such carriages to produce the effect intended, reference being had to the drawings or figures hereunto attached; that is to say: My said invention consists of an apparatus made of iron, (or other fit material or materials,) which for brevity I denominate a sledge or sliding sole, or a safety wheel, (when a wheel is attached thereto,) and which is constructed in the following manner, or consists of the following parts.

Fig. 13, (Plate VII.) A represents what is properly the sledge or sliding sole, having two pivot holes to allow the back and fore braces (which will be immediately described) to be attached to it with the action of joints or-

 hinges.

hinges. This should be turned up at one or at both ends, to prevent its burying itself in the road, and should be from three to six inches broad, and from eight to twelve inches long.

Fig. 14, B or B represents the back brace, having the pivot hole *a*, by which it is attached to the sledge or sliding sole by means of a pin passed through both, and properly secured in its place. *b b b* are catches, to allow the sledge or slider to be brought into action at a height suited to the height of the horse. These catches may be of any form that will lock them in an eye (described hereafter), attached to the middle of the axle; or, instead of these catches, holes *c c c* may be pierced through the brace, into which a pin may be put to keep the back brace in its place. To this is joined a ring or hook *e*, shewn on Fig. 18, to be hooked on Fig. 17, when the apparatus is not in action.

Fig. 15, C C, the two fore braces, having also pivot holes *d d* to attach them to the sledge or sliding sole. The other ends have a ring and bolt, to attach them to the shafts by a screw and nut, or they may be nailed to the shafts, or made fast to them in any workmanlike manner.

Fig. 16, D is the eye which receives the back brace, and which is made fast to the middle of the axle. The eye or opening is shewn by D, Fig. 21.

Fig. 17, E is an iron hook, which is fastened to the hinder part of the carriage on which the ring *e* of the backstay (see Fig. 18) is hooked when the apparatus is kept up from the road or out of action.

Fig. 18 shews the sledge A, the back brace B, the hook or ring *e*, the fore braces C C, all united, and the back brace passing through the eye D, made fast to the axle F, shewn in section.

Fig.

Mr. Brunton's Patent.

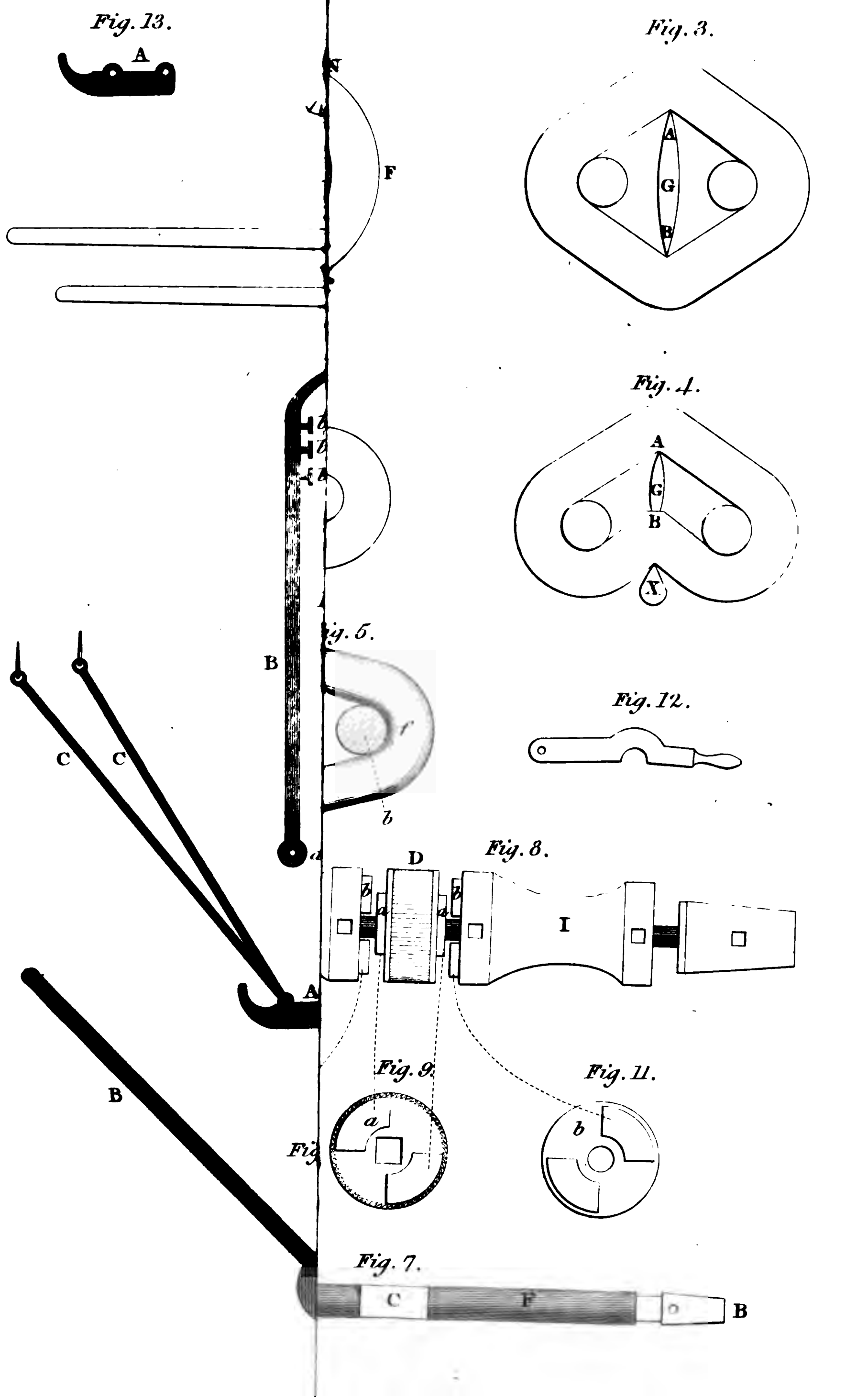


Fig. 19 exhibits the apparatus attached to a carriage, and in action, that is, with the sliding sole on the road.

Fig. 20 shews the apparatus with one small wheel H, (or two small wheels,) substituted for the sledge or sliding sole A.

In the foregoing figures the same letters refer to the same or similar parts; and from the parts viewed separately and joined no competent workman will be at a loss how to execute my invention.

From inspection of these figures the mode of the action of the apparatus may also be clearly seen. When the carriage is to be supported, and the horses back relieved from the load, the ring *e* of the back brace B is to be unhooked from E. (Figs. 17 and 19.) And the said brace is to be moved forward through the eye D (Figs. 16 and 21) till the sledge or slider A, or safety wheel H, Fig. 20, takes the ground; and the corresponding catch or hole, with its pin, is to be made sure in the eye D (Figs. 16, 18, and 21); by which means the shafts and loads will be borne up from the horses back, and security be provided against his being thrown down by the weight of his load when descending a hill. The different parts which I have described may be altered in form, provided the workman keeps in view the end intended to be gained, and adapts all the different parts properly to each other, and to the work they are to perform.

In witness whereof, &c.

Remarks

Remarks on Mr. HOWARD's *Patent for an improved Apparatus for working the Pumps on-board Ships, which may also be applied to Churning, and various other useful Purposes, inserted in the last Number of this Work.*

Communicated in a Letter to the Editors, by the Patentee.

GENTLEMEN,

A PRACTICAL experience for some years of the excessive labour attendant on working the pumps on-board of ships first drew my attention to the subject, and induced me to attempt an improvement; as by rendering that most indispensible and important task less oppressive, I conceived much additional security might be afforded to the lives and property of persons on an element where the utmost exertions have often proved insufficient to avert destruction.

The principle of the invention for which I have obtained a patent is so well understood, and has been so generally acknowledged to be competent to the object, that it was only necessary to observe such a relative proportion in the cog wheels as would give the greatest increase of power, while a constant discharge of a greater quantity of water than could be brought up by the common brake was certain, and to bring the apparatus into such a shape as best suited its situation, and was least calculated to interfere with any of the usual arrangements on deck.

By simplicity of construction its certain action or operation is rendered evident: it may be applied in all cases without altering the pumps, and is capable of such variations in form, that it may be made convenient to circumstances, and suited to a variety of opinions.

The

The advantages which my patent apparatus are calculated to afford consist,

First, in saving the labour of eight men; for instance, if (as is generally the case upon the old principle) six men are necessary to work both pumps on-board of ships, a similar number must be in waiting to relieve them, so that twelve men are actually employed; while with my patent gear only four men will be requisite, *i.e.* two at work and two resting.

Secondly. In its being capable of discharging a greater quantity of water.

Thirdly. In the advantages that result generally from an essential work which was before laborious being rendered easy. And,

Fourthly, in the great additional security which such improvement affords to persons and property, at those times when the safety of both depends almost entirely upon the pumps, and the strength of the men on-board in working them.

In support of the statements I have made of the utility of my invention, I have received a letter from Captain Thomas Gardiner, of the Lord Duncan, after its having been fixed on-board that ship near three months; in which he says, "I am happy to inform you that the works you fitted on the pumps on-board the ship Lord Duncan, under my command, in January last, have given me great satisfaction — two men being able to work both pumps together, and continue the same for four hours if requisite, by which I allow them to do the work of eight men, according to the old custom of using the brake; as such I am fully persuaded that your patent gear is the first invention ever introduced on-board of ships for their preservation when leaky, and managed with few men. Mr. Robert Blenkinsop, my Mate, (the undersigned,) can

can testify this statement to be correct, from personal experience in working the said pumps."

I have also been favoured with communications to the same effect from Mr. John Thompson, the Owner, and Captain Thomas Binnie, of the British Queen Transport, on-board of which ship my invention is now in use.

Lieut. C. Elliott, R. N. Agent Transport, having witnessed the operation of the patent gear, has likewise certified equally in its favour.

Yours, &c.

WILLIAM HOWARD.

Method of making a Calico Printer's Block of a new Construction. By Mr. STEPHEN MARSHALL, *at the Prince's Head, Streatham, Surrey.*

With a Wood Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Isis Medal and Ten Guineas were voted to Mr. MARSHALL *for this Communication.*

PERMIT me to lay before the Society a mechanical improvement which I have made in the blocks for printing calicos, which I think will be of advantage to the public. The invention is quite new: I have never shewn it to any one till within this month. I made it, and printed the goods I have sent with it. If I had made the pattern much closer, it would perhaps have had a better effect with the Society. As you are acquainted with the nature of calico-printing, you will oblige me by explaining the principles of its construction and application.

I have

I have sent herewith a Certificate from Mr. Sutherland, a gentleman well conversant in this business, and I have added some new patterns of the stile of work to which this invention is applicable, and which cannot be executed in the common mode of calico-printing.

*** Mr. Marshall, the inventor, on attending the Committee, explained to them, that by one block on this construction two different colours can be printed at one stroke of the block: and thus a new style of work can be executed, and the finest designs completed, without shewing any joining mark on the cloth.

That in the block produced, which is a striped pattern, the stripes are formed of slips of copper let into the wood, and so contrived that a certain number of them can rise above, or sink below, the surfaces of the others, or form a level surface with them at pleasure; so that if a black and red colour are to be printed at once on the cloth, the red stripes being furnished with colour from the sieve by turning a screw, are drawn down within the others on the block, whilst the black stripes remaining, are furnished with colour. Both parts of the block being thus supplied with their respective colours, are then brought to a level, by turning a screw with the left hand till the two regulating pins near the screw are upon a level and in a line. The block is then laid on the cloth, and struck with the printer's mallet in the usual manner, delivering the impressions of both colours at once upon the cloth. During the whole operation the printer needs never to quit hold of the block with his right hand, and custom so soon reconciles the management of the screw with the left hand, that the block need not to be looked at whilst receiving either colour, but merely to be examined when

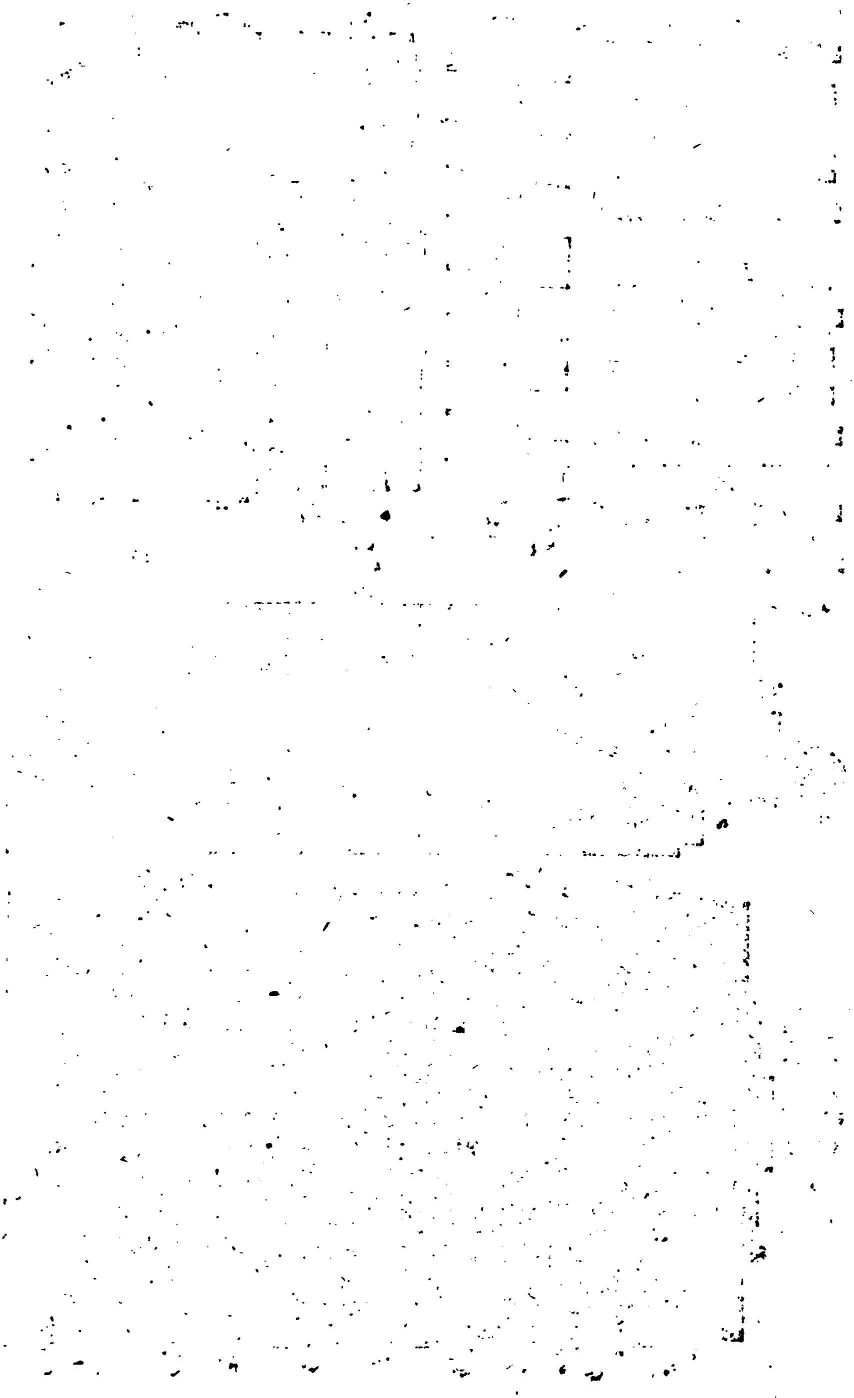
both are finished, to see that the two regulating pins near the screw are placed in a line, and on a level just before the block is laid upon the cloth. Patterns so delicate as to be impossible to be worked in the common way can thus be perfectly executed, and with great facility. Another advantage possessed by printing blocks on this principle is, that one block can be made to produce a great variety of patterns; for instance, in the case of this block of Mr. Marshall's formed to print straight parallel lines only, it is evident, that the wide single lines, lying between the double ones, when elevated above them, form one pattern; the double ones, when the single ones are depressed beneath them, form another, the lines being nearer together; and when all the lines on the surface are brought even, they form another pattern with still closer lines.

Certificate.

This day Mr. Stephen Marshall shewed me a block to print two colours at once, for the use of calico-printers, and about two yards of calico printed by it. I beg leave to say, that I think it the most ingenious printing I ever saw, from my experience of twenty years, in which I have carried on the printing business in the neighbourhood of London. I conceive such patterns cannot be executed upon any other principle, and that it is capable of being extended to many patterns, which the printers before could not undertake. I think this block will enable one man to do the work quicker, and with more accuracy.

This print may be applied to any pattern, and probably to more colours than two. But there are many patterns that cannot be done on any other principle.

Mr.



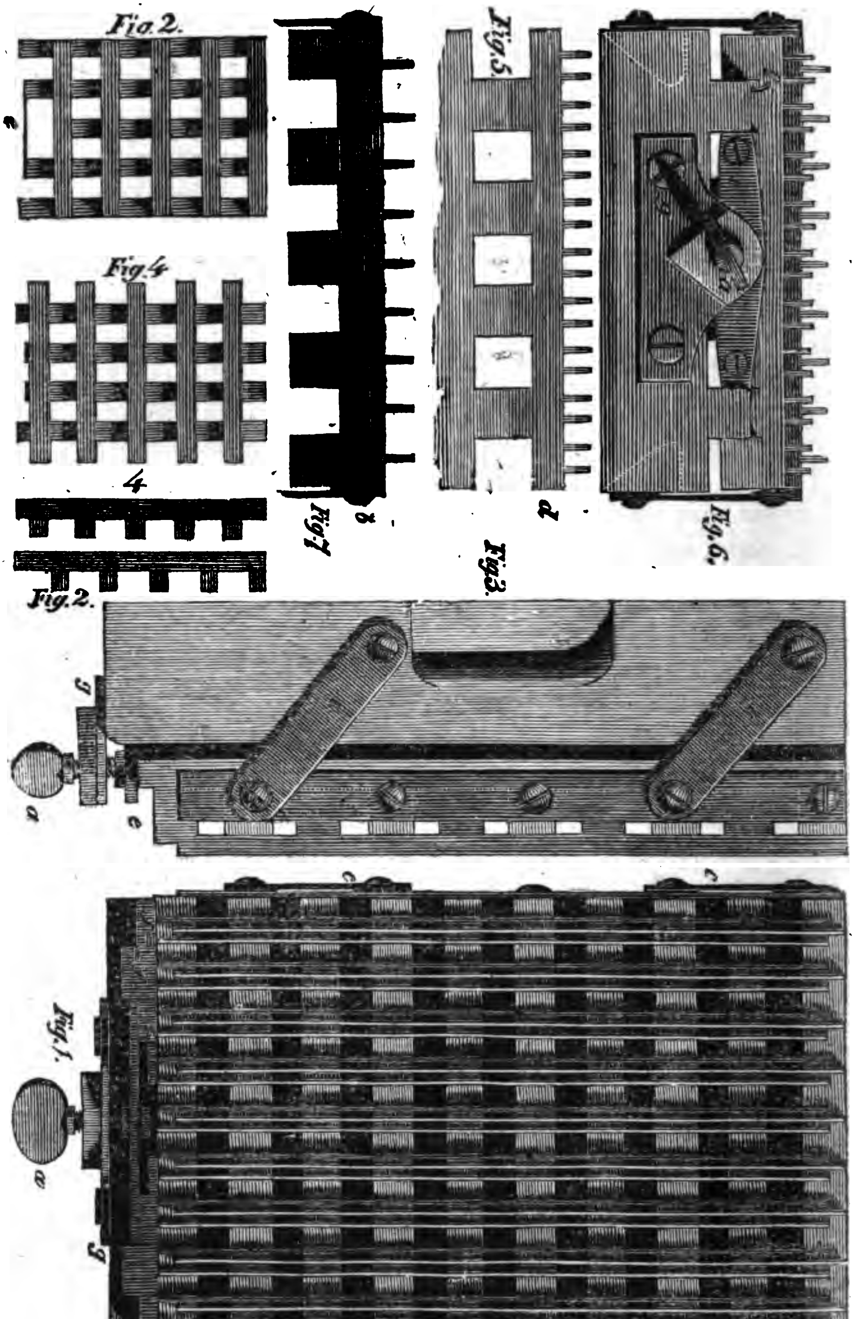


Fig.2.
Fig.4
4
Fig.2.
Fig.7
Fig.5
Fig.3.
Fig.6.
Fig.1.

Mr. Marshall's print appears to me the only improvement certain to be of utility in the mode of printing, called block-printing, that has been produced for the last forty years.

18, *Park Place, Kennington Cross,* G. SUTHERLAND.
May 5, 1814.

REFERENCE TO THE ENGRAVING.

Fig. 1 is the printing-block, with the middle line of each series raised above the two others, by the thumb-screw *a* being screwed in, either for printing single lines or for taking the colour; and then, by the screw *a* being turned back, they may be sunk below the other two outside lines, which may then be either used by themselves, or covered with a different colour; and then, by again screwing up the single lines, till the two regulating pins *ff*, Fig. 1, are on a level, they are all made even, and will print together. *e e* are two pitch pins, for marking dots to guide the printer as usual. *ff* are two regulating pins, the one on the fixed and the other on the moveable part of the block, which, when both are brought in a line together, shew that all the three lines of each series are even on the surface.

The middle lines are carried by the alternate bars *b b b b b*, which are fastened on other moveable bars, as Figs. 2, 2, and 7; and this frame is attached to the block, like a parallel ruler, by copper bars, as *c c*, Figs. 1 and 3, on each side of the block, so that by the alternate motion of the screw *a* they are raised or lowered.

All the outside lines of each series are carried by the alternate bars *d d d d d*, Figs. 1 and 5, which are fastened to other bars, as Figs. 4, 4, and 5, and this frame is immovably fastened to the block itself, as in Figs. 5 and 6.

Fig.

Fig. 6 is an end view of the block, with the middle lines only raised.

Fig. 5 shews how the cross bars *d* are cut away over the five bars of Fig. 7 to let them rise up. The point of the screw *a* is made cylindrical, and moves in a slit in the plate *e*, Fig. 6, between two washers, adjusted by another screw at the end of the screw *a*; and the screw itself works in a female screw, attached to the plate *g*, Figs. 1, 3, and 6, screwed to the front of the block.

On the Means of producing a double Distillation by the same Heat. By SMITHSON TENNANT, *Esq. F. R. S.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

IT was first made known by the experiments of Dr. Black, and has since been confirmed by those of Mr. Watt and other philosophers, that the quantity of heat required for raising the temperature of water from fifty degrees to that of the boiling point, is only about a sixth of that which is afterwards required for converting the boiling water into steam. As the steam itself is not hotter than the boiling water, the heat which it had absorbed was said by Dr. Black to be latent; being merely employed in supporting the aërial state which the water had assumed. Whenever this steam is condensed, the heat which was latent again re-appears, and in such considerable quantity, that it has been found convenient for various purposes to employ the condensation of steam for heating other bodies.

But though water may by this means be brought to the boiling point, it cannot be raised above it, and therefore cannot be converted into vapour, so as to pass over by

by distillation. As soon as the steam has imparted to the water its own temperature, there is no longer any transfer of heat, and the steam passes through the water uncondensed.

If, on the contrary, the steam did continue to condense, then the water would itself be converted into steam, and might by that means be distilled over without any additional fire; and though this does not take place under the usual circumstances, yet it may be effected in the following manner.

The temperature required for converting any fluid into vapour is dependent on the pressure of the air upon its surface, and may therefore be lowered if that pressure is diminished. If then the weight of the air was removed from water it would rise into vapour below the common boiling point, and might therefore be distilled over by steam of the usual heat.

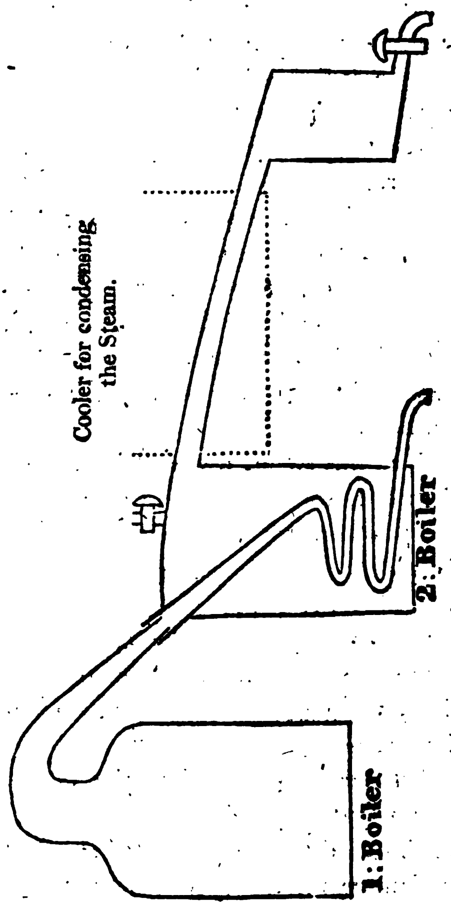
In order to produce this effect, a vessel, having a receiver connected with it, should be made air-tight, and the steam made to pass through the vessel along a worm or spiral tube of metal, in the manner represented in the annexed outline.

The vacuum is now easily produced by applying heat to the vessel till the steam issues from the opening in it, and in the receiver, when they are to be immediately closed, and the heat removed.

The water distilled over is collected in the receiver, which is kept cool for that purpose.

An apparatus of this kind I had constructed chiefly for the purpose of explaining the theory of latent heat, or of the capacity of bodies for heat in different states; but it is possible that it may also be of some further practical utility whenever it is of consequence to economise the consumption of fuel. When water is deficient on-board

board of ship, it has been in some degree supplied by distillation from the ship's boiler; and if the steam from the boiler had been made to pass through this apparatus, the quantity would be nearly doubled.



By an experiment which I had made some time ago, about three-fourths of the quantity obtained by the first distillation were added by the second. But I believe a larger

larger proportion may be procured when the second distilling vessel is duly coated with flannel, or some light substance, to retain the heat.

Though salt water does not boil at so low a degree of heat as fresh water, yet upon trial with sea water the difference was found to be quite insignificant, compared with that of the steam formed under the usual pressure, and *in vacuo;* and did not sensibly affect the result of the process. The only doubt as to the propriety of taking such a vessel to sea, would arise from the degree of danger which there is of experiencing a want of fresh water. This probably, I apprehend, is not great; but, on the other hand, there is the important object of saving the lives of the people in the ship whenever such deficiency is experienced.

On a new Principle of constructing Ships.

By ROBERT SEPPINGS, *Esq. one of the Surveyors of His Majesty's Navy.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

NOTWITHSTANDING the rapid improvement in almost every other branch of the arts and sciences within the last century, it will scarcely be credited by persons not conversant with ship-building, that little or no advancement has been made during that period in naval architecture, so far as relates to the disposition of the materials which compose the fabric of a ship, whereby alone strength and fixedness of the parts can be obtained.

This will appear the more extraordinary in Great Britain, when it is considered that our very existence as a nation depends upon our naval superiority; and when it

 is

is further understood that a deficiency of oak timber, but more particularly that of a large scantling, calls for such an applicatiou of it as will reduce its consumption, and make up for the deficiency of its size.

It is not improbable, that the responsibility which would attach to an individual who should attempt an innovation in a structure, whereby the lives of hundreds might be thought to be endangered, together with the great opposition raised against propositions for any material change in long established customs, may have occasioned this backwardness in naval improvements.

This heavy responsibility, together with the obstacles which are so frequently thrown in the way of projectors, has, without doubt, deterred many men, eminently distinguished for professional abilities, from attempting to carry into effect their ideas on this most arduous and dangerous undertaking: to which may be added, that not merely their professional reputation, but even their peace of mind, might have been hazarded thereby. For if the ship should be lost, although from a very different cause to that of the construction, yet would the weight of censure fall upon the new principle; and the projector would have to endure the whole burthen of the charge, that his schemes had occasioned not only the loss of the ship, but also, which is of far more consequence, the lives of some hundreds of his fellow creatures. Whilst, on the other hand, should the experiment succeed, there would not be wanting those who would be ready to detract from that merit which he so richly deserved, and which would be purchased by him at so great a risk.

The writer of the present paper, in his various propositions for the improvement of naval architecture, has constantly kept in view these two leading axioms, "That the strength of a fabric consists not so much in the quantity

quantity of the materials of which it is composed, as in the disposition, the connection, and the security of its several parts." And, "that the strength of a ship, let its construction be what it may, can never exceed that of its weakest parts," and consequently, "that partial strength produces general weakness."

Three 74 gun ships, now at sea, have already been rebuilt at Chatham on the principle about to be explained; and, from the favourable reports of those ships, the Lords of the Admiralty have given their orders for the building of several new ships upon the same principle.

To shew, in as clear a light as possible, the advantages of the application of this new principle to ship-building, it may be necessary, for the information of those who are not acquainted with that art, to give the following general outline of the structure of a ship on the old principle.

1st. The frame of a 74 gun ship is formed of more than eight hundred different timbers, placed at right angles to the keel, which may be considered as the backbone of an animal, and the frame timbers its ribs. Each rib is composed of several pieces of the thickness of fourteen inches, or thereabouts. Between the several divisions of the frame, or ribs, is a space from one to five inches wide.

2dly. The whole exterior frame is covered with planks of different thicknesses, or, to carry on the figure, the ribs are covered by a skin of greater or less substance from the extreme ends of them to the keel or back-bone. The inside of the frame is also almost entirely lined with planks; within which is another partial range, as it were, of interior ribs, at a considerable distance from each other, termed riders.

3dly. Across this frame are pieces of timber, called

 beams,

beams, united together so as to be of sufficient length to reach from one side of the ship to the other.

The use of these beams is to secure the sides of the ship, so as to prevent her upper-works from spreading, and to keep that part which is under water from being compressed by the fluid. They are also the supports or bearers of the decks, (or what are called in houses the girders for the floors,) and must, therefore, be of such strength as to endure the weight of the cannon, and whatever else is to be placed upon them. The usual mode of fastening these to the sides has, generally speaking, been merely local, by two angular pieces of timber or iron (called knees) bolted to each beam, and also to the sides of the ship, by which means they were only partially held to the side, and there was wanting that continuity of materials, and consequently of strength, which the new system gives.

Between the beams, and at right angles with them, are placed pieces of wood, called carlings, and at right angles with these (consequently parallel to the beams) ledges, which correspond with joists in a house. The planks or flat of the deck (flooring) is laid nearly in parallel lines from head to stern, upon and at right angles with the beams, and is fastened to them and to the carlings and ledges by bolts, nails, or wooden pins, called treenails. From this statement it will appear evident, that the decks, according to the old construction, are in nowise connected with the sides of the ship.

Having thus briefly described the common mode of ship building, it will next be proper to point out such of its defects as the new principle tends to remove.

In the first place it will be perceived, that all the materials composing the fabric of a ship are disposed nearly at right angles to each other.

This

This disposition, which in every wooden fabric is well known to the meanest mechanic to be the weakest, is particularly so in a ship, the immense body of which, subject to violent action from impulses in every direction, is sustained by a greater pressure on the centre than the extremities, arising chiefly from the difference in the fore and after parts of the body to that of the midship, or middle part.

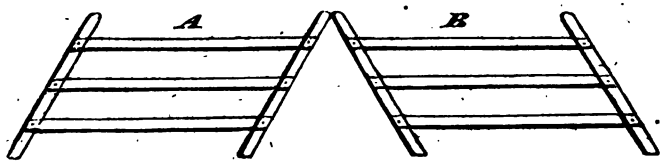
From the want of a continued succession of support from the centre to the extremities originates the tendency to arching, or hogging. This tendency shews itself in a ship from the moment of her launching; from whence some idea may be formed to what extent it will be carried in a troubled sea, when in the act of pitching she is borne up by the fluid only in her central part, while the head and stern are forsaken, and therefore unsupported by the water.

If a straight line be drawn from the head to the stern of a ship, whilst on the slip, or in the dock, no sooner has she entered her own element than each end of this line will be found to have dropped from two to five or six inches, in consequence of the weakness of the fabric, and the two extremes wanting the quantum of support which the fluid gives to the central part.

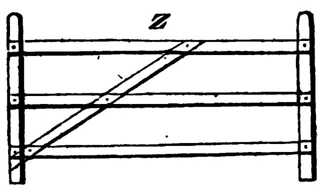
The length of a 74 gun ship being 170 feet or more, it requires but little knowledge of the strength of timber to perceive that planking of that length, however thick, or in whatever way joined or put together, must, under the present system, bend with its own weight. The fastenings, and consequently the connection of the several parts of the fabric, must therefore suffer for the want of *stiffness*, and a change of form is the consequence.

This may be shewn by putting together four pieces of wood, and securing them with iron pins, in the form of a square,

square, which on the least pressure may be made to change its form to the rhombus; but let another piece be fixed to it diagonally, and the figure of the frame will be found immoveable. Place a bar in the middle parallel to two of the sides, and secure it firmly by iron pins, still the figure will easily be moved by the hand, like a parallel ruler, and assume the rhomboidal shape of A or B;



but apply to the frame what the carpenters term the brace in a common field gate, as Z, and the figure will remain, as before, immoveable.



If this brace, or diagonal piece, is not fixed to it, the outer part of the gate (or that part most distant from the hinges) will have a constant tendency downwards, until at length it will reach the ground.

Let Figs. 1 and 2 represent two frames of wood, composed of parts stongly connected by bolts or irôn pins.

Fig. 1 will represent the principle on which the present system of ship-building is conducted.

Fig. 2 the new principle.

Let C C represent the fulcrum, or point of support.

And D D two weights attached for the purpose of ascertaining the comparative strength or stiffness of each frame.

This

This experiment will shew that the stiffness of Fig. 2 is to that of Fig. 1 as six is to one, and the strength as three to one.

The greater the length of the frames the greater will be the advantages of the new principle, both in stiffness and strength.

Fig. 1

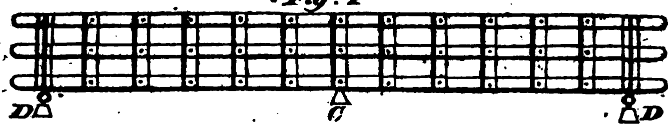
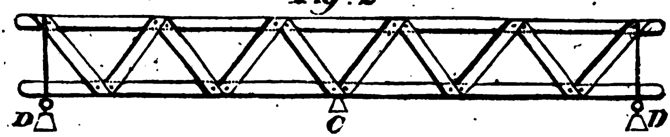


Fig. 2



The substitution of the triangle, as in the frame of Fig. 2, for the rectangle in the frame Fig. 1, comprehends the principle of the new system, the use and advantages of which will be sufficiently evident.

The arrangement of the materials in the triangular mode is such, that the pieces disposed horizontally are acted upon as ropes are by a strain of the fibre, whilst the other parts, composing a series of triangles, are pressed upon as pillars; in other words, the pressure acts in the direction of the fibres of the wood; whereas upon the rectangular, or old plan, the fibres are acted upon transversely, or across the grain, in the same manner as a stick is when placed across the knee and pressed by the hands at each end, which first bends, and then breaks.

To prevent any transverse action upon the fibre of the timber is one of the benefits arising from the new system, and to impede a longitudinal extension of the structure is another.

For

For as the diagonal frame, composed of a series of triangles, aided by diagonal trussing between the ports, prevents the fabric from being acted upon transversely to the fibres of the materials horizontally placed, so the wales, the planking, the shelf-pieces, the improved water-ways, and the decks systematically secured, become the tie-beams of the structure. In a word, the system of triangles is so constructed, in conjunction with the planking of the ship, as conjointly to possess that property of a triangle, already explained, *viz.* that its figure is as unalterable as the compression or extension of the fibre of timber will admit it to be.

The strength of the principle has hitherto been considered as applying to, or resisting an alteration of, the figure, by giving great stiffness. It is now to be taken in another point of view, that of rendering the strength of the fabric as general and united as possible. For let it be again observed, the strength of any body is but equal to that of its weakest part.

In the new system, the openings between the ribs are filled in with slips of timber nearly to the height of the orlop, or lower tier of beams; which being then caulked, and paid or pitched over, makes the frame from head to stern, and within a few feet of the greatest draught of water, one compact and water-tight mass of timber; so that were any of the outer planking of the bottom to be knocked off, the ship would not only still keep afloat, but would be secured from sinking. In the old system the starting of a plank would be, and often has been, fatal.

The mode of filling in these openings between the frame, where the width of the space does not exceed three inches, is by driving in slices of wood, cut wedge-like; two of which being driven, one from the outside, the other from within, form the parallel space of the opening,

opening, thereby bringing the parts into the closest contact. In the openings exceeding the width of three inches, the space is occupied by pieces corresponding with the openings, the fibre of such pieces being laid in the same direction as that of the frame timbers.

These fillings occasion no consumption of useful timber, as one-fourth of the produce of a slab, and other offal now sold as fathom wood, would supply a sufficient quantity for the consumption of the whole navy.

The advantages obtained by filling in the openings are these: To add to the strength and durability of the fabric, to preserve the health of the crew from the effects of the impure air arising from the filth which soon collects in these openings, to render the ship less liable to leakage, as well as to facilitate the stoppage of any leak, and, lastly, to increase, as it may be said, the thickness of the bottom from four, or four and a half, (the usual thickness of the plank,) to about sixteen inches, thereby lessening very considerably the danger to be apprehended from getting on shore, or foundering at sea. That it tends also to the durability of the ship, will be inferred from the following positions:

1st. That the openings in the old principle are, after a ship has had any considerable length of service, choked up in many parts with an accumulation of filth.

2dly. That no free circulation of air can be obtained in these openings by any means.

3dly. That timber being either freely exposed to, or excluded from the air, is equally preserved.

4thly. That it has been found on examining the frame and plank of old ships, that those parts (now filled in) generally decay sooner than the rest, viz. from the floor-heads in the midships, and from the deadwood forward and abaft to the height of the orlop clamps.

 If

If the above positions are true, it will follow, that by filling in these openings much will be added to the durability of the ship; which also will be further promoted by omitting in these parts the inside plank, leaving thereby the surface of the frame timbers exposed to a free admission of air as often as the ship's hold is unstowed, and by the filling in, excluding the air from two of the sides of every timber.

By omitting the inside plank much is added to the internal capacity of the ship's hold. For though the trussed frame projects from the timbers more by five inches than the thick stuff at the floor-heads, yet, as in the old system, the perpendicular riders are brought upon the thick stuff, their projection into the hold is more by eight inches than that of the new, the advantage therefore as to stowage is in favour of the diagonal frame. A tier of iron ballast will also be disposed of in this principle many inches lower, whereby an increase of stability will be given with less weight, which will favour the ship in carrying her ports higher out of the water, inasmuch as greater stability will be given with less ballast.

An accurate conception of the state of the ship's hold may be formed by referring to the longitudial section (Plate VIII. Fig. 1, which is termed the Jesuit's perspective, or bird's-eye view) of the internal part of one side of a 74 gun ship in a complete state, with fillings in the openings between the timbers of the frames instead of the planking over them.

In this state the diagonal timbers are introduced, intersecting the timbers of the frame at about the angle of 45 degrees, and so disposed as that the direction in the fore is contrary to that of the after part of the ship, (as may be seen in the engraving,) and their distance asunder from six to seven feet or more; their upper ends abutting

abutting against the horizontal hoop or shelf piece of the gun deck beams, and the lower ends against the limber strakes, except in the midships, where they come against two pieces of timber placed on each side of the keelson for the purpose of taking off the partial pressure of the main mast, which always causes a sagging down of the keel, and sometimes to an alarming degree. These pieces of timber are nearly as square as the keelson; and fixed at such a distance from it, as that the main step may rest upon them. They may be of oak, or pitch pine, and as long as can be conveniently procured.

Pieces of timber are next placed in a fore and aft direction over the joints of the frame timbers at the floor and first futtock heads, their ends in close contact with, and coaked or dowelled to the sides of the diagonal timbers. In this state the frame-work in the hold presents various compartments, each representing the figure of a rhomboid.

A truss timber is then introduced into each rhomboid with an inclination opposite to that of the diagonal timbers, thereby dividing it into two parts. The truss pieces so introduced into the rhomboid are to the diagonal frame what the key stone is to the arch; for no weight or pressure on the fabric can alter its position in a longitudinal direction till compression takes place at the abutments, and extension of the various ties.

This arch-like-property of the diagonal frame not only opposes an alteration of position in a longitudinal direction, but also resists external pressure on the bottom, either from grounding or any other cause; because no impression can be made in its figure in these directions without forcing the several parts of which it is composed into a shorter space.

The connection which is kept up by means of this

 trussed

trussed frame, firmly attached to the timbers of the ship by circular coaks and bolts, together with the shelf pieces united to the sides and to the several beams by means of the same sort of fastenings, gives such unity to the whole as to bear no comparison with that heterogeneous and badly connected mass of materials for which it is substituted.

It has hitherto been a generally received opinion, that stiffness or inflexibility in a ship is not strength, but that a yielding or bending of the fabric is an essential quality to preserve it from being destroyed by the shocks which it is destined to sustain.

This misconception must have arisen from an equally incorrect idea, which is, that a ship is an elastic body, because there is a considerable degree of elasticity in the materials of which it is composed. But it should be remembered, that this elasticity of the materials must be very inconsiderable, inasmuch as the minute degree of elasticity in each piece must necessarily be neutralised in the fabric, by the various directions and tendencies of the numerous parts of which it is composed, so that a ship, let her construction be what it may, either loose or firm, is not in any case elastic. It follows then, that every action and re-action of the sea operating upon different parts of the fabric at different times, occasions, for the want of unity of the whole of the parts, a constant and increasing weakness, which by some may have been taken for elasticity.

When a sea strikes a ship forward the bow will rise with the sea; which, passing aft, lifts the midships in succession, leaving at this time, in a great measure, the fore and aft parts of the ship with comparatively little or no support. Such shocks, acting upon a body whose parts are not firmly connected, produce a bending and re-

bending

bending of the fabric, so that the several planks of the sides play over each other, and the fastenings are strained and loosened by a repetition of this action and re-action. On the contrary, when a body is constructed with such general unity and fixedness of all its parts, as that if one is moved the whole must move with it, then it may be said that all the parts of the structure bear their portion of the strain.

The decks come next under consideration, the beams of which are disposed in the new system nearly as usual, except that in midships, where a ship necessarily requires the greatest security, two additional beams have been introduced.

The beams of the several decks are attached to the ship's side in the following manner.

1st. By shelf pieces or internal hoops, distinguished by the letter E, Fig. 2. These shelf pieces are composed of several lengths of timber scarphed or joined together by coaks, or circular dowels, so as to form a kind of internal hoop, extending from the hooks forward, to the transoms abaft, to the underside of which, as well as the under parts of the beams, they are securely coaked, and being then firmly bolted to the side, instead of becoming a mere local fixture of the beam to the ship's exterior frame, as knees were, they are one continued and general security. The shelf piece is also a tie to the top side in a fore and aft direction, co-operating with the trussed frame, as already explained.

2dly. By checks, represented in Fig. 2, letter H, which are placed under all the shelf pieces in wake of the beams, except the orlop, in such a manner as to receive the up and down arm of the iron knees. The lower ends of those under the gun deck shelf piece, step on the ends of the orlop beams; and those of the several decks above, step

step on the projecting part of the spirkelting below. The chocks, particularly those between the orlop and gun decks, admit of their being driven into their respective places very tight, thereby acting like pillars. Another advantage attending them, is their great tendency to stiffen the ship's side, and to prevent the beam ends from playing on the fastenings when the ship is rolling, or straining under a press of sail.

The curved iron plate knees for securing the orlop beams, and the iron forked knees of the other decks, are described in Figs. 3 and 2.

The flat or planks of the several decks being, on the old system, each of them a mere platform, or, in other words, a cover to a box unconnected with the sides, are here so disposed of, as not only to oppose an alteration of figure from a force acting on the ship in a lateral direction, but also are made subservient towards securing the beams to the sides of the ship.

The framing and flat of the decks (excepting the quarter-deck, forecastle, and round-house, which are laid upon the old plan) are disposed of, as represented in Fig. 5. The former, that is, the framing or ledges and beams in ticked lines, the latter or planks in black; those of the starboard side being laid contrarywise to the larboard. The midship ends of the diagonal planks abut against two strakes laid in a fore and aft direction without side of the comings of the hatchways; the other ends approach the timbers of the frame, and the buts at each end are secured to a tier of carlings placed for that purpose. The flat or plank of the deck so disposed is connected with a certain number of coaks to the hooks, beams, and transoms. When the decks are thus laid, waterways, described in Fig. 2, are brought upon, and coaked to the ends of the plank. These waterways being then

then bolted through the ship's sides, and also, in an up and down direction, through the flat and shelf pieces, combine the whole in one homogeneous mass of strength.

Few ships are without some complaint of apparent weakness after three or four years service. These defects among other places shew themselves at the beam ends, which partial complaining proceeds in a great degree from the local attachment of the beams to the ship's side, and the flat or covering being in toto unconnected, as already explained. The extreme ends of the beams not being properly secured, play and work upon the fastenings, so that it is not unusual to see the bolt holes cut to an oval figure by the friction of the bolts. The remedy usually applied to a ship in this state is to load her with additional materials, such as iron knees, standards, breast-hooks, &c. thus adding greatly to the original weight of the fabric. Now, it is evident, that the first gale of wind the ship encounters, after being thus partially strengthened, she must be reduced to the same state of weakness she was in before the remedy was applied.

This mode of strengthening ships may be compared to that of a raft firmly secured in the first place by strong lashing, which after some time works loose, or rather by working is stretched. As it might be too tedious a business to secure the raft by re-tightening the lashing, a small cord, or some twine, would be used to answer the purpose. It is clear that whilst the small cord or piece of twine remained tight no part of the strain can bear upon the strong but loose lashing, till the other stretches or breaks; so it is with a ship that has additional securities given her without re-fastening those which had worked, or were much strained.

To

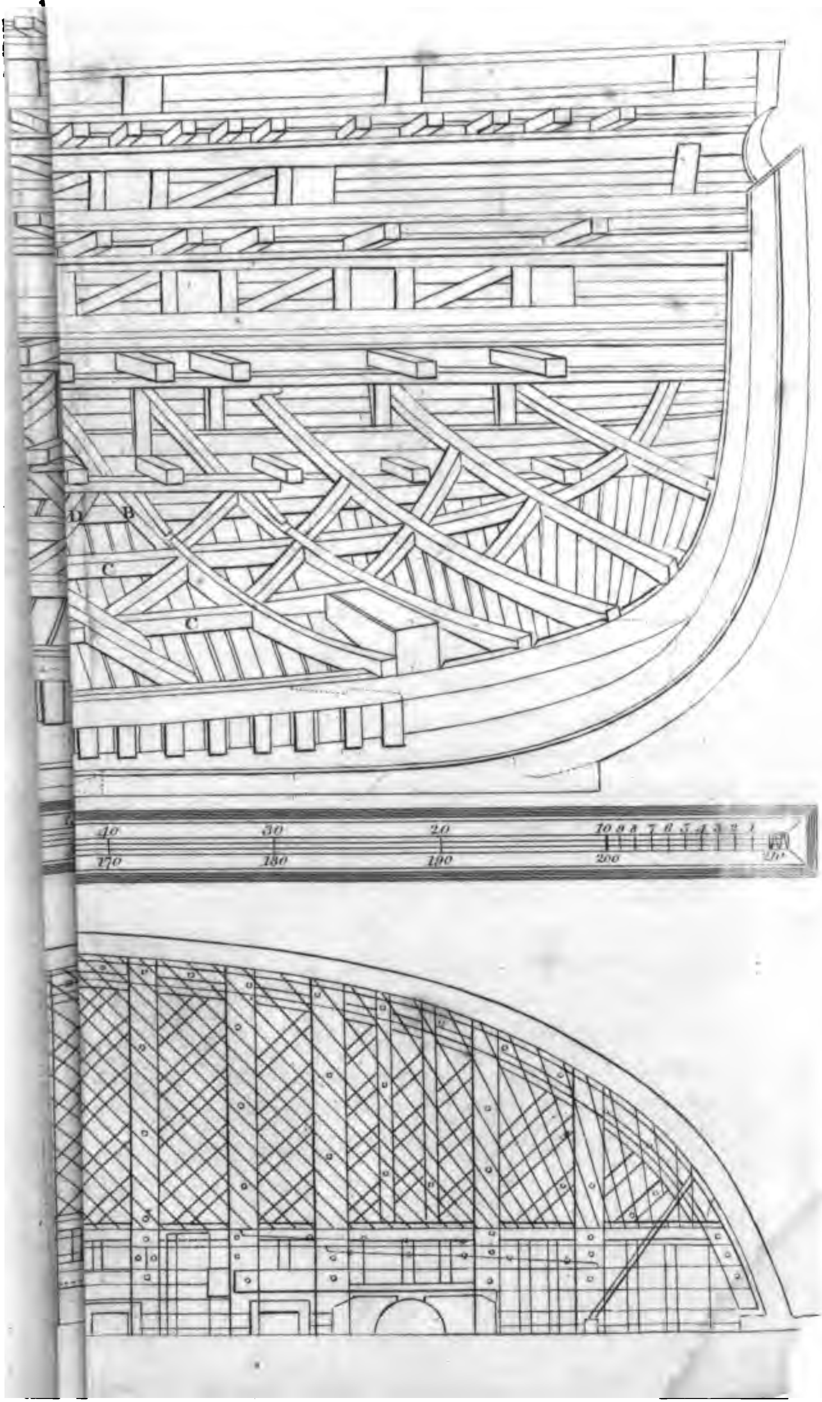
To remedy defects, whether arising from the decay of the materials, or from any other cause, the principle now applied has many advantages, of which a slight inspection of the ship's hold (Fig. 1) will convince, but in no respect is this advantage greater than in the decks, for by shifting them when worn too thin for caulking, the original connection between the beams, decks, and sides, will be restored as perfect as at first.

The tendency of the ship to stretch or draw asunder in her upper works, being by no means obviated by the short planks on the inside between the ports, a truss piece of plank is substituted in lieu of them, which being well secured at the abutments, very materially aids the trussed frame, and gives great stiffness, thereby opposing the inclination to arch or hog aloft.

Fig. 4 represents the stern of a ship with the trussing and iron work for its security. By this the helm port transom, which consumes one of the largest and most difficult trees required for a ship, is dispensed with.

Those essential qualities of strength, safety, and durability, having been detailed, a few observations with respect to the economy of the new principle may not be misplaced, which though but of a secondary consideration compared to the others, yet as the royal navy cannot be kept up without a supply of foreign timber, it evidently becomes a subject of considerable moment, that upwards of one hundred and eighty oak trees should be saved in a 74, and a greater number in larger ships, allowing each tree to measure a load, or fifty feet rough contents.

The consumption of this scarce article may be further considerably lessened in the new system by the use of inferior, and old ship-timber, which cannot be employed in the other; and if old ship-timber was to be generally introduced


D
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200

introduced, as was done in the Ramilies, one-seventh part of the English oak required for a new 74 gun ship might be saved.

The facility of ascertaining the state, and making good the defects of the frame in the lower part of the ship, in consequence of omitting the inside planking, will also occasion a considerable saving of timber and workmanship: indeed the great ease by which any part of the diagonal frame may be replaced, justifies the making use of fir timber, particularly for the longitudinal pieces and trusses.

But should the well-grounded hopes of durability be realized, the saving of timber, and indeed of every article required for this enormous branch of the national expenditure, would be immense.

The author of this paper cannot conclude without observing, that the appointment of most excellent and meritorious officers to the ships already completed on his principles, may be considered as a most favourable circumstance towards ascertaining the real merits of the construction.

Indeed, the orders for carrying this new principle of constructing His Majesty's ships into effect, were directed by such an honourable spirit of liberality; and so unshackled was the authority given, to enable the writer to carry his plans into execution, that no subterfuge can avail him should any failure be found in the system.

Reference to the Plate.

Fig. 1, (Plate VIII.) a longitudinal section.

Fig. 2, a transverse section. A A, limber strake and additional keelson, forming abutments for the lower part of diagonal frame. B B, timbers of the diagonal frame.

C, longitudinal pieces to ditto. D, trusses to ditto. E, internal hoop or gun-deck shelf-piece, forming abutment for the upper part of the diagonal frame. F, abutment pieces for trusses between ports. G, trusses. HH, chocks under shelf-piece for iron knees.

Fig. 3, plan of iron knee.

Fig. 4, plan of the stern.

Fig. 5, plan of the gun and upper decks.

Fig. 6, plan of the breasthooks and crutches.

The same letters refer to the same parts in the different figures.

On destroying and preventing the Pine Bug.

By Mr. ALEXANDER MUIRHEAD, *Gardener to Sir John Belsches, of Invermay.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

The Silver Medal was voted to Mr. MUIRHEAD *for this Communication.*

SINCE my last communication I have seen some pine plants very much infested with the bug, and have completely cured them. According to your request, and in order that the cure may come sooner to the public, I shall endeavour to give the necessary directions as distinctly as possible.

First, take a small brush, made of bass-mat, tied on a small stick, flat on the other end, to go down to the under end of the leaves where the bugs harbour most. With the brush and water clean them as well as possible; then put one pound of flowers of sulphur to one common garden panful of water; if a little more there is no danger

danger of hurting them — the quantity according to the number you have to clean: put the pine plants into this liquor, and let them remain for twenty-four hours; be sure they are all covered, which may be done by putting a board over them, and a small weight on it: when they have been immersed for twenty-four hours take them out, set them on end with their tops down, let them stand till they be dry; then pot them, and treat them in the same manner as plants not infected.

Do not replace them among infected plants; if they are to be put into a pit where infected plants have been, remove the old tan or leaves and put in new.

There need not be so much sulphur-liquor made up at once as may be necessary to cure a whole stock; but as one quantity of plants comes out you may put in another: I have not found it to lose the effect. I last winter made up some in a pot, and as the fruit was eat I took the crown and suckers that were on the plant, and put them, time after time, into the same liquor, and found no defect in the cure. If in winter, it will be advisable to take the chill off the water, and keep it in a stove; if convenient to be done in summer, the plants will take growth sooner.

Some presume to say, that healthy plants will not take the infection. I beg leave to differ from them. I got it by introducing plants, not knowing them to be infected. I have at present some plants which I cured two years ago; and there is not the smallest vestige of the bug to be seen, which may be proved by inspection.

The way that I pursued to clean my stock was this: I took crowns and suckers year by year (after performing the cure on them) and put them in a pit by themselves, filled with fresh leaves, as I use leaves only.

I do not think it advisable to apply the cure to fruiting

 plants.

plants. By shaking the earth from their roots, and otherwise going through the cure, the fruiting would be injured.

I even did not trust my lads to clean my plants, but did it myself. I think I cleaned from twenty to thirty *per hour*.

Method of preserving Apples and Pears.

By Mr. James Stewart, *at Pinkie.*

From the Transactions of the Caledonian Horticultural Society.

THE best time for gathering fruit is when it begins to drop off spontaneously. This is from the middle of September to the end of October. Ladders which will reach to the top of the trees must be provided; likewise baskets for the reception of the fruit. In plucking fruit, the best rule is to take what appears ripest in your hand, and raise it level with the foot-stalk; if it parts from the tree lay it carefully into the basket, otherwise let it hang. The trees should therefore be examined every three or four days.

In the fruitery, the fruit is to be laid in heaps, and covered with clean cloths and mats above, or with good natural hay, in order to its sweating. This is generally effected in three or four days; and the fruit may be allowed to lie in the sweat for three or four days more. They are then to be wiped, one by one, with clean cloths.

Some glazed earthen jars must then be provided, with tops or covers; and also a quantity of pure pit-sand, free of any mixture; this is to be thoroughly dried on a flue. Then put a layer of sand, an inch thick, on the bottom of the jar; above this a layer of fruit, a quarter of an inch,

inch, free of each other. Cover the whole with sand, to the depth of an inch; then lay a second stratum of fruit, covering again with an inch of sand, and proceed in this way till the whole be finished. An inch and a half of sand may be placed over the uppermost row of fruit. The jar is now to be closed, and placed in a dry airy situation, as cool as possible, but entirely free from frost.

The usual time at which each kind of fruit ought to be fit for the table being known, the jars containing such fruit are to be examined, turning out the sand and fruit cautiously into a sieve. The ripe fruit may be laid in the shelves of the fruit-room for use, and the unripe is carefully to be replaced in the jars as before, but with fresh dried sand.

Some kinds of apples managed in this way will keep till July. Pears will keep till April; and the Terling till June.

On destroying the Green Fly, &c. and on bringing Pear Trees into a bearing State.

By Mr. WILLIAM BEATTIE, *Gardener to the Right Hon. the Earl of Mansfield, at Scone.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

I BEG leave to submit to the Society a method, which I have practised with success, for the destruction of the green fly, as well as the black vermin that infest cherry trees.

Take one peck of unslaked lime; put it into an hogshead; fill it up with water, having first bored a hole to draw it off by about a foot or nine inches from the bottom, so that the lime, when slaked, may lie under the hole:

hole: let it stand twenty-four hours, then draw it off; and add half a pound of common soda, such as is used for washing, to the hogshead of lime-water. Twice or thrice watering with this liquor, by means of a garden-engine, will destroy the vermin. Care must be taken not to exceed in the specified quantity of soda, otherwise it will destroy the foliage, being very acrid. The tub containing the lime may be filled up a second time with water, stirring it well up, and may be used as before, adding the soda. New burnt lime is best; for I found that lime that had lain some time did not act so speedily, though by repeated application it answered the purpose.

Bringing Pear Trees into a bearing State.

It may be proper for me first to state to the Society the nature and state of the trees on which my experiments were tried.

The garden at Scone is only five years old, the soil very strong in general, and the trees very luxuriant; in particular, peaches; and pears so much so, that although they were nearly covering the walls, I never had any blossom for fruit. In June 1811, when nailing in the young shoots, the trees still appearing luxuriant, I began to think of some method to check their rapid growth. Cutting the roots of trees *in winter* has been often represented by writers as sure to throw them into a bearing state; but it had not the desired effect with me, although I had adopted that plan two winters before. I now, therefore, began to think of cutting the roots at this period of the year (June), but was somewhat afraid of killing the trees. I, however, made the experiment on two peaches; and, after a week, I saw no alteration in the foliage.

foliage. I then proceeded to cut the roots of the rest of my peaches, and also of two pears, an Autumn Bergamot and Golden Beurré; and this spring I had the satisfaction of seeing a very fine show of blossom, fruit being out of question this season (1811). The pears were both uncommonly full, the Golden Beurré in particular. I believe, indeed, that tree in general bears early. From the success (as I thought) that attended this experiment, I have this year cut the roots of the whole of my pears on a South aspect, consisting of Colmars, Cressanes, Poir d'Auch, &c. The result shall be communicated to the Society.

As some pears bear principally at the extremities of the branches, perhaps by training them in the fan manner, and laying in some young shoots yearly, they would probably bear the second year, or, more properly speaking, the third, when the shoots are two years old all over the tree.

Memoir on a new Febrifuge. By M. ARMAND SEGUIN.

Read to the National Institute.

From the ANNALES DE CHIMIE.

MY experiments, with relation to the febrifuge principle of quinquina, having convinced me that a great part of those of commerce are inactive, and frequently even pernicious, because they are deteriorated, mixed, or deprived of the febrifuge principle, suggested the idea of trying, whether it was not possible to discover an invariably identical febrifuge principle, more efficacious, more certain in its effects, more assimilable with our system, and less liable to be adulterated. That which I am

am about to describe possesses all these advantages, with the additional one of being indigenous.

For the purpose of discovering it, I began with submitting most of the chemical and medicinal substances to the whole of the re-agents, which I have pointed out for the febrifuge principle of the quinquina, and with ascertaining whether such of those substances as might contain the febrifuge principle, did not at the same time comprehend other substances prejudicial to the animal economy.

The adoption of this new febrifuge is of such interest to our commerce, which annually exports more than three millions (of francs), to produce a principle which we have closed at hand; to humanity in general, and in particular to that useful class of society, which, though most subject to fevers, on account of the bad quality of its food, cannot without great difficulty, owing to its poverty, procure the remedy which is to effect a cure, that I request the class to appoint a commission, charged to repeat, at my expense, the experiments that I am about to detail.

The new febrifuge principle which I propose to substitute for quinquina, because it possesses all the advantages of the latter, and has none of its inconveniencies, is gelatine. Like good quinquina, it precipitates tan and gall-nut, but not sulphate of iron. Its febrifuge property is so efficacious, that I have not yet met with any fevers, continued, quotidian, or nervous, fevers attending puberty and dentition, tertian or quartan, however confirmed, that have not yielded to its action.

When properly administered, this remedy almost always reduces continued or quotidian fevers the very first day. In all other fevers, even the most obstinate, it diminishes very considerably, at the first application, the violence

violence and duration of the hot and cold fits, especially the latter; it decreases them still more at the second, and removes them entirely at the third, fourth, or fifth, paroxysm at farthest.

It ought to be taken at the moment when the symptoms of the cold fit begin to be felt. As soon as it has been administered, the amendment of the patient is sometimes so rapid as to seem almost miraculous, and the effect of magic. In a few moments the fingers become supple; in fifteen or twenty minutes, and frequently even sooner, the pains felt in different parts of the body abate considerably, and often cease altogether; the oppression upon the chest is removed, and the respiration, which is sometimes so obstructed that the inspirations are almost convulsive, becomes free and easy.

During the whole time of the disease the patient should be well covered, and not take any violent exercise; keep his room on the day of the paroxysm; abstain as much as possible from liquid food of all kinds, from fruit, spices, and spirituous liquors; live chiefly upon thick soup and meat, of the best quality, boiled, or preferably roasted; and, above all, drink extremely little, however thirsty he may be. As to the quantity of food, it should be so proportioned to the appetite of the individual, that he ought never to be completely satiated, and still less cloyed.

Besides the application of the remedy at the moment of the paroxysm, it ought likewise to be taken morning and evening during the whole time the fever lasts, and even for a certain time after it is over. In cases of dentition or growth, it is even advisable to continue it till they are past. In general the patient should not eat within an hour after the cessation of the paroxysms, or an hour after the application of the remedy, if it be taken in the intermissions.

 The

The progress of the cure by this remedy is in general very regular. Whenever the fever is not removed at the first fit it changes its nature; from quartan it becomes tertian, sometimes remittent, and at length ceases. From the commencement of the treatment the chokings diminish; the intestines become open, and perform their functions with ease; the tongue ceases to be furred, and the lips, which were discoloured, resume a fine vermilion tint. In a very short time after the cessation of the paroxysms, the patient, from the continued use of the remedy, is thrown into strong sweats, which he must by no means try to abate, because they tend to complete the cure. The fæces, which during the disease were in general black, then recover their natural colour.

The remedy may be administered in different doses, according to the constitution of the individual, and the force of the fever. On this subject nothing but approximations can be given: it is the province of the physician to regulate the doses, according to circumstances. However, not to leave that matter in absolute uncertainty, I shall state the proportions that have succeeded best with me in the different circumstances that have fallen under my observation.

To children at the breast up to the age of one year, may be given from 24 grains to 1 drachm at each application. For a child from one to three years old, from 48 grains to 2 drachms may be employed; for a child from three to seven years old, from 1 drachm to 4; for a child from seven to twelve years old, from 2 to 6 drachms; for persons between twelve and sixteen, from 2 to 12 drachms: and for all above that age from 2 drachms to 3 ounces.

To remove all fear of danger in regard to these proportions, I can assert, that before I administered this remedy

medy to any patient, I took myself so much as eight ounces of gelatine at once; that is to say, thrice as much as I commonly give in the most violent paroxysms, and that I experienced no sort of inconvenience from it, except a slight degree of fatigue and drowsiness.

If the patient is so reduced that he is unable to digest, that his strength is almost entirely exhausted, and he is sinking into consumption, which too frequently happens from improper treatment, or the too-long continued use of quinquina, injudiciously administered, the dose of gelatine should be gradually increased till the fever is radically cured, and then mix a draught, composed of cinnamon and sugar, infused in good wine, with a dose of from four to eight ounces *per* day. By this method I have saved, and radically cured, patients who seemed past all hope of recovery.

I have in general remarked, that in very obstinate fevers it is advisable to give the remedy in a dose sufficiently large during the paroxysm that the patient may find himself for twenty-four hours more exhausted, and his head more painful, than he would have done from the effect of the paroxysm alone. But in the succeeding paroxysms it is proper to administer large doses in the intermissions, and much smaller ones at the beginning, of the paroxysms,

Quinquina should on no account be used at the same time as the gelatine, for the paroxysm then increases in violence.

When fevers are caused by worms, it is necessary to expel them before the gelatine is administered, otherwise the complaint is only aggravated. The same course must be pursued when the fevers are accompanied with other disorders; for, unluckily, gelatine is not an universal remedy.

When it fails to produce a very considerable amendment after the first paroxysm, as is the case in certain kinds of fevers, particularly the nervous, the use of it should not be continued except as an indirect medium, if it be judged that in this new way it may produce some effect.

As to the mode of preparing the gelatine, that which I employ is as follows: Select the driest and most transparent gelatine; dissolve it in a sand-bath, in three parts of water; add equal parts of sugar, and some drops of orange-flower water. Keep it in this state of jelly, and at the moment of applying the remedy dissolve in a sand-bath the quantity that is to be administered. The sugar and orange-flower water have nothing to do with the efficacy of the gelatine; they merely serve to disguise in some measure its natural insipidity.

The gelatine may likewise be prepared in the form of cakes, and in this state it may be kept for any length of time, and will bear to be conveyed to any part of the world. I make these cakes in the following manner:

I take very transparent gelatine; mix with it an equal weight of sugar, and thrice its weight of water. Having thoroughly dissolved this mixture, I add a small quantity of orange-flower water, and pour it into a glass mould, which contains as many superficial inches as there are drachms of jelly in my mixture. When it is become quite hard I take it out of the mould, and lay it upon a wire grating, forming in like manner squares of an inch each: when almost dry, I cut it according to its divisions. When these cakes are wanted for use, nothing more is necessary than to dissolve them in the smallest possible quantity of water, and thus to take them in a liquid form; or they may be suffered to melt in the mouth.

Considered

Considered in a medicinal, political, and economical point of view, gelatine affords in its application to the cure of fevers much greater advantages than quinquina. It occasions no kind of irritation; procures sound sleep, and a gentle perspiration; keeps the body open, without colic or heart-burn; recruits the strength, and is digested even by the weakest stomachs, which would throw up quinquina as soon as it was administered.

As the too long-continued use of quinquina is attended with serious inconveniencies, it is usually taken only for a short time after the cessation of the paroxysms. For this reason it frequently happens, that fevers cured by means of quinquina return some time afterwards, either from humidity or defective digestion, or a variety of other circumstances; and in this case the treatment of them becomes much more difficult. Gelatine is never attended with this inconvenience, for its use may be continued as long as the disorder requires, and can never do any harm.

In regard to economy, there is a great difference between quinquina and gelatine. The price of the latter compared to that of the former is at most in the proportion of 1 to 32.

All the experiments upon which the principles here laid down are founded were made in my infirmary, or in the adjacent places, as Buc, Bièvre, Sèvres, and Meudon, in the presence of M. Balzac, surgeon of Jouy, who displays extraordinary zeal for the advancement of medicine.

I shall confine myself for the present to a concise account of the principal cures which I have effected.

A lad of fifteen, in my employ, had for three months and a half a quotidian fever, the paroxysms of which lasted about ten hours. His debility was such, that he wept

wept almost all day, without knowing why. He had never taken any quinquina. The first day that I put him into my infirmary I gave him two drachms of gelatine, at the moment when he began to feel the paroxysms coming upon him. In less than an hour the shivering passed off, and never returned. It was but seventeen days before he was completely cured.

The cooper of my brewery had a very violent fever, which had reduced him the more as he was a man of sixty. I began to treat him at his ninth paroxysm. I gave him three drachms of gelatine. The shivering, which commonly lasted three hours, ceased in half an hour, and the hot fit, which usually continued eleven hours, lasted only two and a half. At the second paroxysm there was no shivering, and the hot fit lasted but one hour. At the third paroxysm the fever totally disappeared, and never returned. His complete cure took only twelve days.

One of the men employed in my stables had had a fever for five months. From a tertian, which it originally was, it had changed to a quartan, in spite of a very great quantity of quinquina that he had taken. For a fortnight he had discontinued the use of that remedy, because his stomach could no longer endure it. On the first day that I took him in hand I gave him six drachms of gelatine; his stomach was not in the least disordered, and digested it well. His paroxysm abated from that moment by more than one half. Three days afterwards the paroxysm did not come on at all, and he was completely cured in nine days.

M. Seguin states several other cases which were attended with similar success; but our limits will not allow us to give them.

Additions

Additions to the Description of the Process for dyeing Silk of a Prussian Blue. By M. Raymond. *Published by the Government in* 1811.

From Archives des Descouvertes for 1815.

THE most remarkable, and at the same time the most useful, addition which M. Raymond has made in his process, consists in the passage of the silk through an almost boiling and very strong solution of white soap, after it has received its ground of rust in the bath of calcined copperas, (super-oxygenated sulphate of iron,) and been cleansed in the river.

By this passage of the silk through the soap the oxyd of iron with which it was impregnated becomes much more strongly fixed in it, and at the same time acquires a much higher degree of oxydation, as is proved by the deep walnut colour assumed by the rusty ground, in consequence of this immersion in the hot solution of soap.

M. Raymond's process is as follows: Dissolve in a sufficient quantity of boiling water one part of white soap for four parts of silk. The soapy water which has been previously used for washing out the gum will serve extremely well for this purpose, if strengthened by the addition of one-half part of fresh soap to four parts of silk, and employed very hot. When the soap is completely dissolved, and no clots are to be seen in it, [for the greater certainty, it is advisable to strain the boiling solution through a cloth, or to tie up the soap in a clean linen bag before it is put into the boiling water to be dissolved] —plunge into it the silk impregnated with its mordant of ferruginous oxyd, and well cleansed from it in the river; continue to turn it upon the poles till it has entirely recovered its clearness, which will be the case after four or five

five dips, whenever the soap-bath has been properly prepared, that is, when it is almost boiling, and has been made in the proportion above mentioned. The solution of soap employed for this operation need not be lost, as it may be afterwards used for boiling those silks which are to receive ordinary and dark colours.

The silk after being taken out of the soap-bath should be well washed in the river, before it is plunged into the bath of prussiate to give it the blue colour.

"I have ascertained," says the author, "that it is necessary to add to the bath of prussiate a larger quantity of muriatic acid than has been stated in the description of the process; otherwise the blue colour cannot develope itself upon the silk. I advise, therefore, that two parts of muriatic acid be used for one of potash, since, how well soever the silk may have been washed after the soap-bath, it always retains a portion of the soap, the presence of which, preventing part of the effect of decomposition, which ought to be produced on the prussiate by the action of the muriatic acid, renders it necessary to increase the proportion of the latter.

"I have likewise ascertained, that it is advantageous not to turn the hanks of silk at all upon their poles in the bath of prussiate of potash till such part of the hanks as are plunged into it have completely assumed the blue colour which they are to acquire in consequence of the intensity of the rusty ground with which they have been impregnated. It will be sufficient, therefore, to raise up the hanks of silk in, and even out, of the bath, eight or ten times, and to stir them well in it; after which they may be replaced in it, that the other parts may in their turn become blue. No uneasiness need be felt respecting the inequalities which are at first to be perceived in the colour, as it cannot possibly fail to be communicated in the most

most uniform manner whenever the ground of oxyd of iron has been properly given to the silk.

"When a very deep shade of blue, like that called *imperial*, is desired, it is then necessary to pass the silk, at two different times, through the mordant of calcined copperas, taking care to give it a strong infusion of soap almost boiling between and after the baths of the mordant. In this manner you are always sure to obtain a very deep ground of rust, which will render it fit for taking an extremely rich blue, when it comes to be plunged into the bath of prussiate of potash, duly acidulated by the addition of a sufficient quantity of muriatic acid.

"The dipping of the silk in ammoniacal liquor, to deepen the colour and render it more fixed, is now become an operation useless at the best, and which cannot answer the purpose, except with great quantities of silk at once, by employing a very small proportion of that alkali, and taking care to dilute it with plenty of water; otherwise it would be liable to make the blue too deep in some places, and too pale in others. Instead, therefore, of the very delicate operation of dipping in ammonia, (volatile alkali,) it is advisable to give the silk, after it has been dyed and well washed in the river, without beetling, two or three plunges in a vessel three parts full of water, to remove the acid which prevents the blue colour from acquiring the red tinge that is to add to its richness. It afterwards deepens to the degree required by the mere contact with the air; and it has been fully ascertained that it gains by this method, especially when the silk has been passed through soap subsequently to the copperas bath, a beauty and solidity superior to those which it derives from the treatment with ammonia.

"It may not be amiss to inform here such manufacturers and dyers as may not be acquainted with the cir-

 cum-

cumstance, that it is an essential property of the Prussian blue colour, communicated to silk, to redden and deepen, for a fortnight at least, by the mere contact with the air. Hence those two changes are produced and completed in a perfectly uniform manner till the silk comes to be wound, that is, till the twist presents all its surfaces to the oxydating action of the aërial fluid; and not till then is it found to have acquired all the development and all the richness of which it is susceptible.

"There cannot be any doubt, that by means of the details into which I have here entered concerning the corrections and additions, which operations performed on a large scale have enabled me to make in my process for dyeing silk of a Prussian blue—there cannot be any doubt, I say, that this process will be found to answer completely by all the dyers who will give it a fair trial, since it is a fact, that there is not a single establishment at Lyons, St. Etienne, and Avignon, where it is not practised, in the most satisfactory manner, by means of the improvements which I have here described."

By means of this addition the blues obtained with prussiate of iron, otherwise termed *Raymond's blues*, are at least as brilliant, and the silk is quite as soft to the touch, and as easily wound, as in blues which are produced with the sulphuric solution of indigo, and known by the name of *composition blues*; and they have this advantage over the latter, that they are much more beautiful, and at the same time more solid.

Processes

Processes for making Water-colour Green.

By M. Lenormand.

From his Manuel du Fabricant de Vert-de-gris.

THE acetate of crystallised copper is employed in painting and for varnishes. These crystals are in great request for the beauty and the solidity of the colours which they furnish. They yield by distillation an acid, with a very powerful smell, called radical vinegar, which is used by apothecaries.

The solution of verdigris in acetic acid is used to colour the parchment employed in binding books, as well as the shagreen with which cases destined to hold valuable objects are covered.

We shall here give two processes for preparing the liquid called water-colour green, which is so much sought after by the designers of geographical maps and geometricians, and the composition of which is very little known.

First Process.

Take equal parts of cream of tartar and verdigris, both well pulverised; mix them completely, place this mixture upon a sand-bath, gently heated, and leave it for the space of seventy-two hours. Then add as much distilled water as you have used of cream of tartar, and continue to heat gently for six hours. Filter the liquid, and to prevent it from sinking into the paper, add a sufficient quantity of the whitest gum arabic, and you will then have a most beautiful and excellent green for washing plans.

This colour is unalterable, and will keep in small bottles for any length of time; but, for the great facility of carriage, you may fill small saucers with it, and leave it

to evaporate, either spontaneously or on the hob of a stove, taking care to replenish the saucers as the liquid diminishes. By this method you obtain this beautiful colour in a solid form.

Second Process.

The colour obtained by this second process is not by far so beautiful as the preceding: but as draughtsmen have occasion for several shades to diversify their drawings, we shall give the receipt for it.

Boil for half an hour, in a varnished earthen pot, two decagrammes of verdigris with half a litre of water; stir the whole with a wooden spatula, and add one decagramme of cream of tartar. Let it boil a quarter of an hour longer, and then strain through a rag. Set the liquid again on the fire, and let it boil till it has diminished one-third. Add, as above, some of the whitest gum arabic.

This colour may be obtained in a solid form by reducing as above directed. A few drops of water poured into a saucer will dilute a sufficient quantity for use at one time.

Infringement of Patent Right.

Court of Chancery, August 10, 1815.

GEORGE, *v.* BEAUMONT, WACKERBACK, and MARTINEAU.

THIS was an application for an order to dissolve an injunction, which had been obtained to restrain the plaintiff from using a certain method of refining sugar, by which it had been alleged the patent rights of the defendants were infringed.

It

It appeared that a patent, procured by a Mr. Constant, for refining sugar *, by the means of wood or other vegetable charcoal, had been purchased by Messrs. Beaumont and Wackerback; that another patent had been subsequently obtained by Mr. Martineau †, for effecting the same purpose by means of animal charcoal, that is, charcoal produced from the burning of bones or other animal substances; and that these defendants had finally agreed, for their mutual interests, to unite their patents. It had been set forth, as the ground of the injunction, that Mr. George, pretending to treat with the present defendants about the purchase of a license from them for practising their mode of refining sugar, had watched the process in their manufacturing houses, and afterwards, without license, put it in practice for his own advantage, and to the manifest injury of their patent rights.

Mr. Bell, who opened the case for the plaintiff, contended that the patents themselves were not good, the process of refining by means of charcoal being no new invention, but had been particularly described in "The Repertory of Arts," published in February, 1813, long anterior to the date of either of the patents, and had been practised by himself three months before the earlier of the patents, as had been testified by the affidavits of his two sons and four labourers. Under such circumstances the learned Counsel hoped his Lordship would dissolve the injunction.

Sir Samuel Romilly, for the defendants, denied the doctrine advanced by Mr. Bell, relative to the distribution of licenses, as not being implied in the meaning of the statutes referred to. The practice, on the other hand, was fully justified by usage, and by the very words of the

* See his patent in this work, vol. XXI.

† Published in this Number.

the patent itself. As to the defence set up by Mr. George, that he had collected his knowledge from the essay in the "Repertory of Arts," it was very strange that he should have suffered two years to elapse before he made any use of it. But, by his own account, the experiments which he had made with charcoal in the refinement of sugar were abortive until he had improved his practice, not by "The Repertory," but by means of what he was permitted to see in the manufactories of the defendants, while he was pretending to negociate with them for a license.

Mr. Hart, on the same side, observed, that Mr. George did not deny that he had been infringing on the patents, contending only, that the same materials had been used for the same purpose before; but, as to his having acquired his knowledge from the source suggested, the plea was absurd, and inconsistent with his own testimony. In November 1814, it was plain, by his correspondence with Mr. Hudson, that he had no such knowledge. In consequence of what that gentleman had imparted to him, he says, in a letter to Mr. Hudson, that he had tried the experiment of refining by charcoal, but failed. He then observes, that the failure might be owing to his using lime-water instead of pure water. It was strange that he could be thus ignorant of a process with which he professes himself to have been before familiar. Mr. Hudson, in his reply, omitted any notice of what had been said as to the cause of failure, but warned Mr. George not to infringe on the patents. As to what had been said on the subject of charcoal in "The Repertory," it referred not to the clarification of sugar, but to the qualifying of acids; and, with respect to the originality of the invention, it was not necessary that every part of a new and useful invention should be such as had never existed before; a knife was necessary to shear cloth, but a knife might

might be contrived of a new form and construction, which would do the work much better than a common knife, and might on that account entitle the contriver to the rights of a patentee. *It was not the principle, but the application of the principle, that must be new.*

Mr. Leach, on the same side, referred to a former case, in which his Lordship had laid it down as a rule, that the novelty which was required in the title to a patent *lay in the new and useful application of a principle,* whether the principle itself was then first advanced or not. It was plain, that in May, when Mr. George was negociating about a license, he was quite ignorant of the process and principle, and so expressed himself to Mr. Wackerback and others, to whom he mentioned his surprise and astonishment at the effects which they allowed him to witness. His taking advantage of what he had thus been permitted to see under the pretext of taking up a license, was a gross fraud.

The Lord Chancellor had generally been of opinion, that patentees were rather hardly dealt by, though he knew there were some sound opinions at variance with his own in that respect. It was impossible for him to forget the arguments which on a former occasion had been used by Mr. Leach and Mr. Hart, arguments not exactly consonant to those they had used to-day. He should, however, dismiss that impression from his mind, and apply his judgment, as well as he was able, to the plain facts delivered to the Court, and by no means urge the rights of patents beyond their lawful limits. The patents might be right, or they might be partly right and partly wrong. They might give too extensive an authority to the holders. They might empower their possessors to interfere with the fair and proper use of materials belonging to their trade, and to say, "We are armed with the

law

law against you, and you must not use those materials unless you can shew us that our patents are good for nothing." Great inconvenience to his Majesty's subjects must arise from the imperfect nature or doubtful interpretation of the rights of patentees. A new method of improving a machine might be devised, and a patent obtained for it: but that would be no obstruction to the use of the old one. The main and the first question was, whether the patents were good or not, and the best mode of determining that would be to proceed by law, for it was only in a few special cases that that Court could properly enter on such subjects. The patents must be protected until they were found to be bad. The affidavit of the plaintiff states, that he had been in the practice of proceeding by the process named in the patent three months before the date of the patent. He was by no means prepared or inclined to justify the mode by which the plaintiff appeared to have acquired information while he seemed to be looking for a license from the defendants, yet having got his knowledge, even by such exceptionable means, it would be difficult to prevent him from using it. The question simply was, whether the patents were good or not, and that was plainly a question of law. If they should be determined good, damages might be recovered to the extent of their violation, not only by the patentees, but by the persons who had obtained licenses from them. What he should recommend would be, to take the question into a Court of Law, and in the mean time he would order that an account be kept by the plaintiff of the number of pans which he employed, and of the quantity of sugar produced by the new mode of refinement.

After some observations from the different Counsel, the injunction was dissolved.

THE
REPERTORY
OF
ARTS, MANUFACTURES,
AND
AGRICULTURE.

No. CLXI. SECOND SERIES. Oct. 1815.

Specification of the Patent granted to JOHN FRANCIS WYATT, *late of Furnival's Inn, Engineer; for new kinds of Bricks or Blocks, one of which is particularly adapted for the Fronts of Houses and other Buildings, giving to them the Appearance of Stone; another is applicable to a new Method of bonding Brickwork; also a new kind of Blocks or Slabs for paving Floors, and facing or lining Walls instead of Ashlar, which will resemble Marble or Stone, and which may be applied to Steps, Stairs, and other Parts of Buildings.*

Dated February 15, 1815.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Francis Wyatt do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described as follows; that is to say: I prepare thin pieces, plates, or slabs of stone, of sizes to fit the sides and ends of the bricks, or blocks, or masses or lumps, intended to be used in the fronts of buildings. These pieces, plates, or slabs, being previously cleaned and wetted, are then placed in moulds; and Parker's cement, or what is more commonly

known by the name of Roman cement, or any other proper cement, in a fit state of moisture, is laid upon them, and which is to remain till the cement be sufficiently indurated and united to the stone; or the cement may first be put into the moulds, and the pieces, plates, or slabs of stone laid upon it, and remain till the cement be sufficiently indurated and united to the stone. They are then to be taken out of the moulds, and piled up or placed in a proper situation for drying; the longer they are exposed to the atmosphere, the harder they will become; and in a few months, or a shorter period, they will be hard enough for use, without the application of artificial heat. The pieces, plates, or slabs of stone, need not be more than half an inch thick, but may be thicker or thinner, according to the discretion of those interested in the work. The quality of the stone to be used for the pieces, plates, or slabs, is best if somewhat bibulous or porous; and for this reason I prefer Bath stone, but Portland or even marble may be applied if the cement be such as will cohere to the stone or marble. Although I recommend, for the purposes of this invention, the cement prepared according to James Parker's patent, dated one thousand seven hundred and ninety-six, yet any other cement possessing the property of becoming so indurated in a short space of time, is proper for the purpose. It is not necessary to use Parker's or any other cement without the admixture of any other materials; on the contrary, it will be advantageous in many cases to mix with it clean rough sand, small gravel, fragments of bricks, flint stones, shingle, scoria of iron, copper slag, and other such materials; taking care that the proportion of Parker's, or other proper cement, be sufficient to make a strong union with the pieces, plates, or slabs of stone or marble, and the other materials.

The

The moulds I use in making these bricks or blocks, or masses or lumps, I do not consider as a part of the invention: those used in making bricks in the common way will answer the purpose, only the bricks or blocks, or masses or lumps, must remain longer in them to become indurated than is used in the common way of brick-making.

For bonding brickwork I make protuberances on the upper side of each brick or block, or mass or lump, so that such protuberances shall nearly fit or fill the hollow left in the under part of the brick or block, or mass or lump, on which it is to rest: and when walls are to be built exceeding nine inches in thickness, I build two thin walls, either brick on edge, or otherwise parallel to each other, and fill up the intermediate space with a composition of cement, sand, rubble, or such like materials, thereby connecting and bonding the two walls together, as represented in the section of the wall, Fig. 1.

For facing or lining walls, only the inner wall may be built with bricks or blocks, or masses or lumps, and the outside or external one may be of real or artificial stone, as represented at A A, in the section Fig. 2.

Fig. 1.

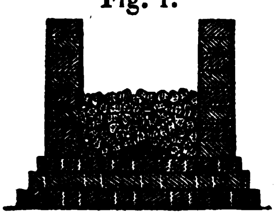
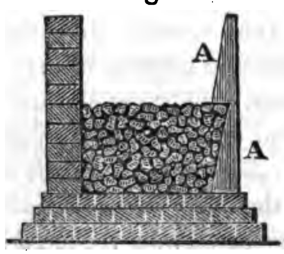


Fig. 2.



Paving blocks or slabs are made in the same manner as the faced bricks or blocks, or masses or lumps, either by laying the thin pieces, plates, or slabs of stone or marble, at the bottom of the mould, and applying the

 cement

cement or composition upon them in a proper state of moisture, or by putting the cement or composition into the mould first, and placing the stone or marble upon it, and left till sufficiently indurated before taken out. These blocks or slabs may be either entirely or partially faced with bibulous stone, or even marble, and when partially faced they may be laid in ornamental figures; or the stone may be first laid; or the blocks or slabs separately shaped and prepared, and the design engraved upon the surface, and undercut, and the cement trowelled into those parts; or the stone parts of the pavement may be laid in their intended situations on the floor, with sufficient cement underneath to raise them all to a level surface, and the spaces between them afterwards filled up with cement to the surface of the stone: and when sufficiently indurated, rubbed down to a smooth surface by any of the usual methods. The steps or stairs are made in the same manner as the bricks or blocks, or masses or lumps.

In witness whereof, &c.

Observations by the Patentee.

That valuable property which the Roman cement is known to possess, of becoming in a short time as hard as stone, points out its peculiar eligibility for the employment of it in buildings, and by combining it with other durable materials, in the form of bricks, and laying them in the said cement instead of common mortar, a building may be thereby rendered literally a stone edifice; for the cement (when deprived of its water with which it is mixed to render it plastic, which is the case after a short exposure to the atmosphere) does actually become stone. By their being made without artificial heat they retain the

the exact form of the moulds in which they are made, so that accuracy is preserved in laying them without much trouble, and much less cement or mortar is required than with any other kind of bricks.

Pointing is not necessary either for use or beauty; and as water cannot penetrate them, they are an effectual preventive of damp walls. When laid in putty or fine mortar, of which but little is required, they make excellent work, the joints being hardly perceptible.

The expense of a front of these bricks will not be more than one of fine malm stocks when pointed, as in consequence of their uniformity in size and shape they will be laid in much less time than any other kind of bricks. Closers and arches * will be furnished at prices proportioned to the rest, so that no loss is occasioned by waste in cutting, which in other bricks is considerable.

The other parts of my invention, described in the specification, I have not practised to much extent; but in a short time I hope to furnish the Editor with the result.

Orders are executed by Messrs. James Grellier and Co. Old Swan, London Bridge, where specimens may be had, and references given to buildings whieh are now carrying up with the Roman bricks.

* The mode I have adopted to put in camber and other arches differs from the usual way. Instead of cutting each arch-brick (or *voussoir)*, and building the left hand skewback, and then, after the arch is put in, work the other skewback up to it, I build both skewbacks or abutments, and support a piece or pieces of stone cut so as to form the soffit and face of the arch, (about an inch in thickness,) and then turn a band of brick-work, bedded in cement on the inside, and afterwards make saw carfs on the front and soffit of the stone, to represent the radial lines of each *voussoir.*

Specification

Specification of the Patent granted to THOMAS BAGOT, *of Birmingham, in the County of Warwick, Surveyor; for a Method and Machine for passing Boats, Barges, and other Vessels, from a higher to a lower Level, and the contrary, without Loss of Water.*

Dated April 4, 1815.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Thomas Bagot do hereby declare the nature of my said invention, and the manner in which the same is performed, is described in the drawings and specification in these presents contained; that is to say: Let U (Plate IX.) in the plan represent the upper level of a canal, and L the lower level thereof, and let A A A A in the plan and section represent the walls of a lock or locks, connecting in the usual manner by means of sluice-gates *u u* and *l l* in the plan, U the upper and L the lower levels of the said canal, and let B B B in the plan and section represent the walls of a reservoir, which I denominate the forcing chamber. The walls of such lock or locks and reservoir being supposed to be built in a firm and durable manner, of brick, stone, or other proper materials or combination, of materials capable of containing water without leakage, and of sufficient strength to resist the utmost hydrostatic pressure that may at any time be exerted upon them; and let the reservoir, which I call the forcing chamber, communicate at the bottom or the lower part thereof with the lower level of the said canal by a conduit or conduits marked C in the plan, furnished with a valve or set of valves *v v v* in the plan, opening inwards into the said forcing chamber; and let there

there be a conduit or conduits, as shewn at *b* ——▸ *a*, *b* ——▸ *a*, in the plan and section, forming a communication between the lower part of the said forcing chamber and the lock or locks; such conduit or conduits being furnished with a valve or valves, as shewn at *a* in the section, opening inwards into the said lock or locks, and with a paddle or paddles at *b b*, next the said reservoir or forcing chamber, to cut off the communication between the forcing chamber and either lock as may be required. Let *p p p p* denote paddles in *l l*, the lower gates of each lock, as shewn in the plan, which paddles being drawn, open a communication between each lock and the lower level of the said canal, and by drawing such paddle or paddles the lock or locks are emptied of water. W denotes a wier, to carry off any surplus or waste water by *c c c c c*, a culver or culvers from U, the upper level of the said canal, to L the lower level thereof, and to equalize the depth of water in the different ponds or levels of the said canal.

f f f f denote foot bridges, firmly fixed and attached to the upper and lower gates of the locks; which bridges form a communication between the locks and the towing-paths, or opposite sides of the said canal, as may be required. And let the dotted quadrantal arcs and arrows shew the direction in which *u u* the upper, and *l l* the lower, gates of the said locks open.

In addition to the above, let there be a vessel constructed and made buoyant, which I denominate an evacator, of such dimensions as just to float in the said forcing chamber without touching the sides thereof; which evacator may be formed of iron, wood, or any other proper material, or combination of materials, capable of being made water-tight; and let such evacator be furnished with a valve or valves to regulate the weight with which

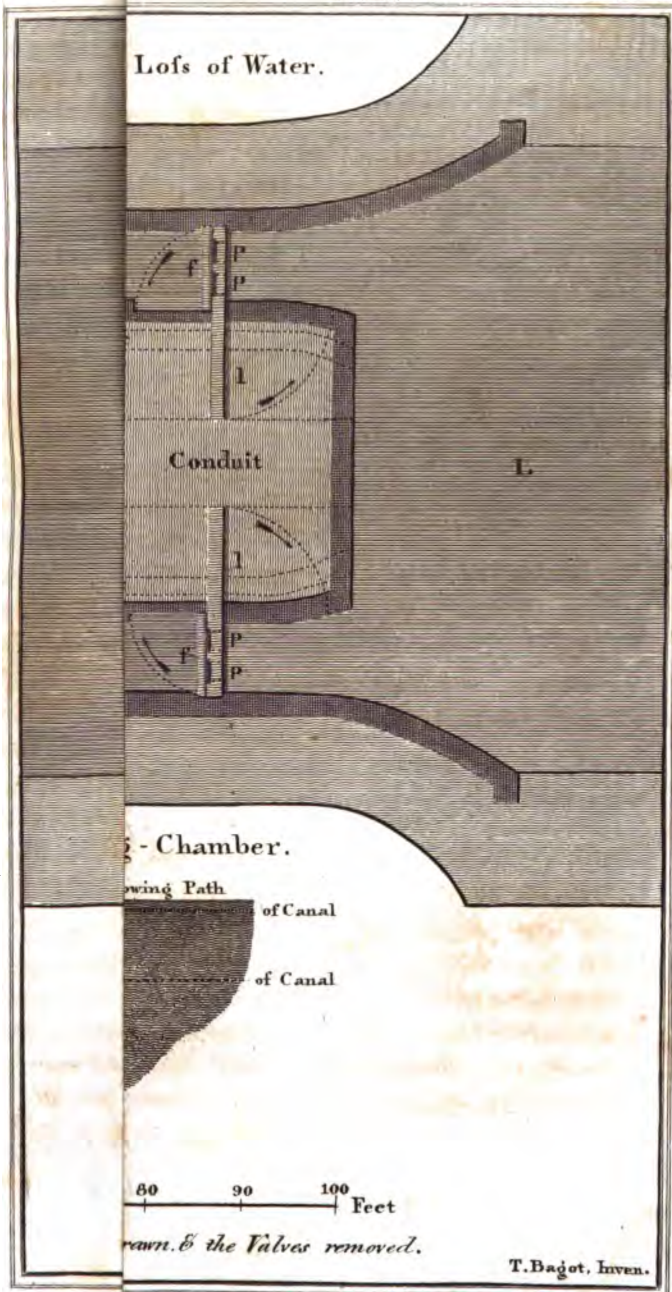
it

it may be loaded, by suffering a quantity of water to flow into it equal to the degree of buoyancy which it may be required to possess; and let such evacator be furnished with a man hole or holes, similar to the boiler of a steam-engine, to enable the internal part to be at any time inspected if found necessary.

Now, as there is a regular communication between the lower level of the canal and the lock or locks, and between such lower level of the canal and the forcing chamber, and likewise between the forcing chamber and lock or locks through the respective conduits, as shewn by the direction of the arrows, except when such communication shall be cut off, either by the paddles between the forcing chamber and locks being let down, or by the action of the valves, as hereafter mentioned; it follows, that the water in the lower level of the canal, in the forcing chamber and locks, will each have one common level, and from which level I intend to derive the water I may require to pass any boat, barge, or other vessel, as by the following examples will clearly appear.

Suppose it were required to pass two boats, barges, or other vessels, from the lower pond or level L of the canal into the upper one U at one time. I suppose the boats, barges, or other vessels, are floated into the respective locks designated by the Italic letters *A* and *B*, the lower gates *l l* shut, and the paddles *p p p p* in each of the lower gates let down or closed. The communication is now cut off between each lock and the lower level of the canal, except through the conduits C and $b \longrightarrow a$, $b \longrightarrow a$. Now, supposing a pressure to be exerted on the upper surface of the evacator which floats in the forcing chamber sufficient to overcome the buoyancy thereof, the evacator will sink in the forcing chamber, and thereby displace a bulk of water equal to the cubical

content


Loss of Water.
Conduit
L
f
p
p
l
l
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-Chamber.
wing Path
of Canal
of Canal
80
90
100
Feet
rawn. & the Valves removed.
T. Bagot, Inven.

content of the part immersed by such pressure. Immediately on such pressure being applied, the valve or valves *v v v* (connecting by means of the conduit or conduits C the forcing chamber with the lower level of the canal) close; and those shewn at *a a* opening inwards into each lock, open; and the water in the forcing chamber by such depression and force is driven * out of the reservoir or forcing chamber into each lock.

The water in the forcing chamber being, by the downward pressure of the evacator, forced into each lock, is now considerably below the line of level of the lower pond of the canal, and the pressure upon the evacator in the forcing chamber being removed, the water immediately, by its hydrostatic pressure, opens the valves *v v v*, and rushes through the conduit C, in the direction of the arrows, into the forcing chamber, to restore it to the level of the lower pond of the canal. The pressure being again exerted upon the evacator, the water is again driven into the locks by the valves *v v v* closing, and those of *a a* opening, by the pressure of the column of water upon them; and the forcing chamber being, or supposed here, of equal surface or area with each lock, and the lock having seven feet rise; if the evacator be made to sink in the forcing chamber at each depression two feet and four inches, or a little more, both locks will

* Although I here use the term *driven*, the water really falls, in consequence of its hydrostatic head or pressure. For, as the pressure is exerted on the evacator, it displaces a column of water equal to the cubical content of the part immersed by such pressure, as before stated, and being so displaced, a portion of the water rises up by the sides of the evacator so immersed, and acts by the following law of hydrostatics: That a column of water, however small in its lateral dimensions, will balance or equipoise a column of water, however large, if there be a communication formed between them.

 then

then be filled by six depressions of the evacator, and the upper gates of the locks being now opened, the boats, barges, or other vessels float out of each lock into the upper pond or level of the canal *.

Now the water in each lock *A* and *B* being raised to the upper level U of the canal, supposing there was only one boat, barge, or other vessel ready to descend to the lower level of the canal, which boat, barge, or other vessel (no matter whether empty or loaded) I will suppose floated into the lock *A*, and the upper gate *u* being closed, the paddles *p p* in the lower gate of the lock being drawn, the communication is now opened between the water in the lock and the lower level of the canal; the water in the lock *A* subsides, and the boat, barge, or other vessel, upon the lower gate of the lock being opened, floats into the lower level L of the canal †.

We now find the lock A empty, (as it is called,) or upon the same level with the lower pond of the canal, and the lock B full, or upon the same level with the upper pond of canal.

* By this example two boats, &c. are shewn to be capable of being raised from the lower level of the canal to the upper one at the same time without any expense or loss of water whatever, such water being shewn to be entirely supplied from the lower level of the canal, but which, by the present mode of passing boats, &c. would have required an expenditure of upwards of two hundred tons of water to have effected the performance thereof.

† Here we find the water which had been in the former example taken from the lower level of the canal to fill this lock, is now restored to the former level of the canal again; and that a boat, &c. has been raised from the lower level of the canal to the upper, and another passed from the upper level of the canal to the lower level thereof, without any loss of water whatever, although, according to the present practice, it would have required an expenditure of upwards of two hundred tons of water to have effected the same.

N.B. These two notes are not in the specification.

Now

Now let us suppose a boat, barge, or other vessel, in the lower pond of the canal, is required to be raised to the upper level thereof; and that a boat, barge, or other vessel in the upper pond of canal is wanted to be passed to the lower level thereof at the same time. In the first place let fall the paddles at *b b*, at the end of the conduits, connecting the lock *B* with the forcing chamber. The communication between the forcing chamber and the lock *B* being now cut off, draw the paddles *p p* in the lower lock gates of the lock *B*, and the boat, barge, or other vessel in that lock will be depressed to the lower level of the canal. Then apply the depressing force to the evacator, and the water that is in the forcing chamber will immediately rush through the conduits $b \longrightarrow a$, $b \longrightarrow a$, into the lock *A*, and raise the water, and the boat, barge, or other vessel therein. And the evacator at each depression thereof sinking two feet and four inches, or a little more, at three such depressions, the boat, barge, or other vessel is raised to the upper level of the canal, and floats thereout on the upper gate *u*, of the lock *A* being opened; at the same time that the boat, barge, or other vessel in the lock *B* being depressed to the lower level of the canal floats into the lower pond of the canal, on the lower gate *l* of the lock *B* being opened. And by this means an alternate trade, to any practicable extent, may be carried on without the loss of any water whatever; reducing the supply necessary for inland navigation, merely to the evaporation from the surface, and the leakage attendant upon canals in general.

And I hereby declare, that, for the purpose of giving a motive force to, and effecting the depression of, the evacator in the forcing chamber, I employ the power of the hydrostatic press, for which the late Mr. Bramah ob-

 tained

tained a patent; but, instead of using the said press in the manner described in his specification, I alter and reverse the action thereof, by inverting the large cylinder of the press, and making the piston thereof to act downwards, or in the direction of gravity, instead of acting upwards, as therein described. And, for effecting this purpose, I cause a strong framing of iron, or other metal, or any other durable substance, of sufficient strength to resist the utmost stress that the press may be required at any time to exert on the evacator, to be firmly fixed in the walls of such forcing chamber. To the transverse part of which framing I affix, in a firm and durable manner, and in an inverted position, the large cylinder of the hydrostatic press, in which the piston which depresses the evacator slides, and which cylinder having a communication with a small forcing pump or pumps, by injecting water or other fluid into the large cylinder, gives motion to the piston thereof, and thereby effects the depression of the evacator in the forcing chamber; and the pressure of the forcing pump being removed by opening the discharging valve, or in any other way, the water in the lower pond of the canal raises the evacator, and with it the piston of the large cylinder, to its former situation and level, and the operation may be again repeated, as hereinbefore described.

And, for the purpose of giving quickness to the operations thereof, I apply thereto in some cases two or more small forcing pumps, worked by one or more levers, as may be thought necessary, which additional pump or pumps will give such celerity to the motion of the evacator in the forcing chamber that the water in the lock may be raised with much more speed than it is at present done in the best constructed locks; which hydrostatic

static press, as altered and applied by me to the purposes herein stated and set forth, I denominate and call the depressor.

In the present construction of locks there are conduits built in the walls thereof, connecting the upper level of the canal with the inside of the lock; and in many instances conduits are built connecting the inside of the lock with the lower level of the canal with paddles adapted thereto, to cut off the communication between the ponds of the canal and lock, as may be required.

The improvement which I propose to make thereon, is to simplify the lock, by constructing the walls thereof of solid masonry, except in those places where communications are to be made with the forcing chamber, as before specified, thereby increasing the strength and durability of the lock, and lessening the expense of erecting them, and keeping them afterwards in repair.

Another improvement I propose is, to hang the lock gates on the opposite or off side of the lock, as shewn in the plan, and directly contrary to the position they are at present placed in, by which means the towing-paths are kept open, and free from obstructions. Greater facility is given to the passing of horses, &c. in hauling the boats, barges, or other vessels. The levers, or arms of the lock gates, may be made of greater length, so as to act as a more perfect equipoise thereto; and being out of the way of the haulers and towing ropes, become less liable to injury from the friction thereof, and will be more durable.

And I do farther declare, that I adapt such part of my foregoing improvements as regards the saving of water to locks on the present construction, by causing a perforation or opening to be made in the wall or other part

of

of such locks, and thereby forming a communication or communications with a forcing chamber to be added thereto, which forcing chamber must in all cases have a communication, as before described, with the lower level of the canal. And in case of its being a single lock, adapting the valves only to the inside of the forcing chamber and of the lock, for reasons which are hereafter mentioned; so that the lock may then be used either with or without the improvement at any time as may be thought necessary.

And although in the drawings and specification herein contained I have given the principles and plan of operation as applied to two locks, or what is generally termed a double lock, yet the same principle and mode of operation may be equally applied to a single lock, though in this case the paddles, as described and shewn at the extremity, *b b*, of the conduits *b* ——► *a*, *b* ——► *a*, in the plan and section, will not be necessary, they being only useful when the principles developed in this specification are applied to the compound operation of two locks, or what is generally termed a double lock.

And I hereby declare, that the principles and machine here set forth and described may be adapted to canals and sluices of all descriptions, and varied in all degrees of magnitude, so as to pass or raise vessels from a lower to a higher level, and the contrary, with the greatest possible celerity, from one ton to one thousand tons burthen and upwards.

And although in the drawings accompanying this specification I have described the forcing chamber as having an equal area with each lock, and as being rectangular, yet the form and dimensions thereof may be varied at pleasure.

And

And although I have not mentioned of what materials the conduits are to be constructed, yet I consider they may be formed of masonry, or may be made of cast iron, with valves fitted to the ends thereof, or in any other way that may be deemed most effectual for the purposes intended.

And although I have described the operations of effecting the elevation of the boat, barge, or other vessel in the lock, by the depression of the evacator, yet it will be immediately seen, that the same may be performed by loading the evacator with water, so as to have a preponderance therein, and balancing the weight thereof, by an equipoise or counter-weight, and giving motion thereto, by racks, pullies, wheels, and pinions, or other well-known mechanical contrivances; or effecting the same by making the power of the hydrostatic press act upwards upon the evacator. But though I mention these different modes of construction to prevent any evasion of the principles of my said invention, or any part thereof, yet I consider the mode I have laid down in this my specification as the best adapted to effect the purposes wanting, in the most effectual, cheap, and expeditious manner.

In witness whereof, &c.

Observations by the Patentee.

According to the construction of the above lock, independent of the saving of water, every advantage is gained, in the most simple, effectual, and rational manner. The towing-paths, instead of being obstructed, as they are at present, by the arms of the lock gates and paddle posts, are entirely clear for the passage of horses, &c. and no obstruction whatever is presented to the action of the haulers and towing ropes; and the locks themselves not having

having any conduits in the walls thereof, are simplified in their structure, are erected at less expense than the present locks, and will be more durable, and freer from leakage.

In addition to the above, the following are enumerated as some of the advantages to be derived from the use of these patent locks.

1st. The use of the apparatus, which is extremely simple, will be readily comprehended by persons of the most ordinary capacity, nor is it liable to be out of repair, or easily deranged.

2d. Boats may be passed in less time than they can by locks on the present construction.

3d. The whole of the water, which is at present lost to the upper levels of canals, and which is shewn to be upwards of one hundred tons for every boat passing through the locks, is saved, and the boats, &c. are passed without any expense of water whatever.

4th. Should it at any time happen that more water is raised into the lock than the upper level of the canal requires, no injury can be sustained thereby; for the only effect will be, that the upper gate of the lock will be floated open, and the extra quantity of water which may be raised, will immediately pass by the weir into the lower pond of the canal again, from which it had been taken.

5th. It will enable companies using this improvement to supply the upper levels of their canals with water without any expense in raising the same.

6th. It will render the expense of making reservoirs for the supplying canals with water unnecessary.

7th. In cases where the upper levels of canals cannot be supplied from reservoirs or feeders; it renders the erecting of steam-engines, and the expense of working them,

them, and of keeping them in repair, unnecessary, and supplies their place without any additional expense.

It will secure to mill owners their full supply of water, thereby rendering any compensation to them unnecessary.

It will enable the advantages of inland navigation to be extended to places where, from local circumstances, and the increased difficulty and expense of supplying the upper levels with water, it is at present impracticable. And,

Lastly. It will render inland navigation more certain and expeditious; for, allowing there to be a sufficiency of water in the lower levels of canals, all the boats passing upwards through the locks, bring their supply of water with them, and the upper levels will at all times be supplied with water from the lower levels, instead of the lower levels taking all the water from the upper levels, as is the case at present. By this means the quantity of water necessary for the supply of inland navigation will be reduced merely to a sufficiency for supplying the evaporation from the surface, and the leakage attendant upon canals in general.

Such are the advantages which are now clearly and rationally laid down by this improved system of lockage, and which are now submitted by the Patentee to the attention of Proprietors of Canals, Civil Engineers, and others interested in the improvement of inland canal navigation, for their consideration and adoption.

Specification of the Patent granted to JAMES THOMSON, *of Primrose Hill, near Clithero, in the County of Lancaster, Calico Printer; for certain Improvements in the Process of printing Cloth made of Cotton or Linen, or both.* Dated February 4, 1815.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in pursuance of, and in compliance with, the said recited proviso, I the said James Thomson do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is as hereinafter mentioned.

The ordinary practice of calico printers is to apply, with the block or pencil, what are termed after-colours to certain spaces, originally left in their patterns, and intended to receive the said after-colours, or to certain spaces on the cloth, from which parts of the original pattern have been discharged, in order to admit, by a subsequent operation, the application of the said after-colours. Now the object of my invention is, by one application of the block, cylinder, roller, plate, pencil, or other mode, to remove parts of the original pattern or colour from the cloth, and at the same time to deposit a metallic oxyd, or earthy base, which shall of itself be a colour, or shall serve as a mordant to some colour to be produced, as hereinafter described.

First, mix or combine with the acid called oxymuriatic acid, (or dephlogisticated acid of sea salt,) and water, the alkaline salts of potash or soda, or, which is still better, calcareous earth, or quick lime, in such proportion as will weaken or suspend the power of the said acid, so that it shall not in such mixed or combined state, of itself,

and without any further operation, be able to remove, or materially to improve the colours within the moderate space of time taken up in the performance of the process.

Secondly, print, stamp, pencil, or otherwise apply to those parts of the cloth which are intended to be deprived of one colour and to receive another, a solution of some earthy or metallic salt; the acid of which having a greater affinity or attraction for the alkaline salt or earth with which the oxymuriatic acid is mixed or combined than that acid itself possesses, will disengage it, and the metallic or earthy base of which being deposited in the cloth, will either of itself be a colour, or serve as a mordant to some other colour to to be produced as hereinafter described.

Thirdly, after the metallic or earthy solution aforesaid has been printed, stamped, pencilled, or otherwise applied to the cloth, as before directed, and is sufficiently dry, immerse the cloth in the solution of oxymuriatic acid, combined with the alkaline salt of potash or soda, or, which I greatly prefer, with calcareous earth or lime, when the acid of the metallic or earthy solution which has been applied to parts of the cloth, will immediately seize upon and combine with the alkaline salt or earth with which the oxymuriatic acid has been mixed or combined, and disengage that acid, which will almost instantaneously deprive of their colour those parts of the cloth to which the said earthy or metallic salt has been applied.

Fourthly, wash or otherwise remove the said acids or salts by the usual processes, and when the earthy or metallic base deposited in the cloth is intended to receive another colour, proceed to raise it by the usual operations of dyeing, as will be further illustrated in the exam-

 ples

ples hereafter given, of particular applications of this invention. The earthy solutions which I apply to the parts intended to be deprived of their colour, and to receive another, are the solutions of alumine, or earth of alum, in acids; such, for example, as the sulphate of alumine, or common alum, the acetate of alumine, or the nitrate or muriate of alumine. The metallic solutions which I employ are the sulphate of iron or copperas, the nitrate or muriate or acetate of iron. The muriate of tin, or nitro-muriate of tin. The sulphate of copper, or blue vitriol, or the nitrate, muriate, or acetate of copper. All acids that form soluble compounds with the before-named metals, or the earth of alum, may be employed; but those only which form the most soluble compounds, such, for example, as those enumerated above, can be employed with advantage. Fot the more full and complete understanding of the principle laid down in the preceding part of this specification, I subjoin the following practical illustration of its application to various kinds of work. If I desire to have a yellow figure or stripe on the cloth upon which a madder red ground or pattern has been printed, after having by the ordinary processes of calico printing produced the red ground or pattern, I first print, stamp, pencil, or otherwise apply to those parts intended to be yellow, a strong aluminous mordant, composed of three pounds of sugar of lead and six pounds of alum, dissolved in a gallon of water, and thickened with a due proportion of calcined starch, in the manner usually practised by calico printers.

Secondly, I prepare a solution of oxymuriate of lime, either by dissolving the dry oxymuriate of lime (commonly called bleaching powder or bleaching salts) in water, or by passing the oxymuriatic acid gas into a vat, vessel, or cistern, in which, by agitation or otherwise, I keep

keep suspended such quantity of quick lime as will more than saturate fully and completely the said oxymuriatic acid gas. In either way I obtain a solution of oxymuriate of lime with excess of lime. That which I use and prefer is of the specific gravity one thousand and fifty, and I seldom employ it lower than one thousand and thirty (water being considered as one thousand). The vat, vessel, or cistern, which contains the solution of oxymuriate of lime in which I immerse the cloth, may be of any size or form best adapted to the purpose or situation. I use and prefer vessels of stone, of from six to eight feet deep, six to seven feet long, and three and a half to four feet broad; but larger or smaller vessels will answer verywell.

Thirdly, when the cloth is ready for immersion, which it is as soon as the paste is dry, I hook it on a frame, such as is used in dyeing indigo or China blues, commonly called a dipping frame, on which the cloth should be so disposed that no two folds can touch each other. I then plunge the frame, with the cloth so attached, into the vat containing the solution of oxymuriate of lime, and keep it gently in motion during the time of immersion, which rarely need exceed five minutes. The object being to remove the red dye from certain parts or places, as soon as that is done the cloth should be withdrawn from the solution of the oxymuriate of lime, and plunged into or rinsed in cold water. I practise and approve the aforesaid plan of immersion, but any other plan or plans by which the cloth can be exposed a greater or less time to the action of the oxymuriate of lime, without bringing one part of the said cloth into contact with another, will answer very well.

Lastly. After having, as before directed, rinsed or washed the cloth in clean water, I free it from all superfluous remains of the different substances employed by the

the ordinary means of washing, dunging, and cleaning, as practised by calico printers; after which I dye the cloth and raise the yellow in the usual way with quercitron bark, or any other yellow dye.

If instead of yellow it is proposed to have a buff pattern or figure, I add to the aluminous mordant, prepared and thickened as above described, one-fourth or one-sixth, or some intermediate proportion, of a solution of nitrate of iron, and proceed to print and immerse in oxymuriate of lime, as in the former case.

The red dye will be removed as before, and its place be occupied by a buff. If the buff be raised in quercitron bark, an olive will be obtained. By printing at separate times, and on different parts of the cloth, each of the above-mentioned mordants, both yellow and olive figures on a red ground may be obtained. Similar effects, with trifling variations, take place when instead of red grounds purple or chocolate grounds are employed; but it must be observed, that these colours being produced from mordants consisting wholly or in part of solutions of iron, and the oxyd of that metal not being removeable by the process detailed in this specification, the after-colours produced will be modified more or less by the said oxyd of iron. The foregoing examples are given for the more full explanation of the said invention, and the manner in which the same is to be performed; but the invention whereof I claim the sole and exclusive use consists in printing, stamping, pencilling, or otherwise applying to cloth, previously printed and dyed, or dyed any other colour than Turkey red, any of the earthy or metallic solutions hereinbefore for that purpose directed, and immersing the whole cloth in such mixture or combination of oxymuriatic acid and water with some of the alkaline salts or earth, as is herein directed

rected for that purpose, so as to remove the colour or pattern from the parts so printed, stamped, pencilled, or receiving such application, and by the same process fix on such parts either a new colour or a mordant for a new colour.

In witness whereof, &c.

Remarks on the Employment of Oblique Riders, and on other Alterations in the Construction of Ships. Being the Substance of a Report presented to the Board of Admiralty, with additional Demonstrations and Illustrations.

By THOMAS YOUNG, *M. D. For. Sec. R. S.*

From the PHILOSOPHICAL TRANSACTIONS of the ROYAL SOCIETY of LONDON.

1. *Introductory Observations.*

THE advantage derived from the employment of forces acting obliquely with respect to each other, in a variety of cases which occur in practical mechanics, has been demonstratively established by theoretical writers on the subject; and attempts have often been made to extend the application of the principle very considerably in the art of ship-building; but hitherto with very little permanent success. Mr. Seppings's arrangements are in many respects either new or newly modified; and the results of their actual employment, in the repair of the Tremendous, appear to be sufficiently encouraging to entitle them to a careful and impartial investigation, both with regard to the theory on which they are supposed to be founded, and to the facts which may be produced in their favour. The question, respecting the best disposition of the timbers of a ship, is by no means so easily discussed as may be supposed by those who have considered

dered the subject but superficially; and if we allowed ourselves to be influenced by a few hasty arguments or experiments, we might be liable to the most dangerous errors: on the other hand, it may easily happen that objections to the application of those arguments or experiments, which may occur at first sight, may be capable of being removed by a more minute investigation: and the importance of the subject requires, that no assistance, which can be afforded by the abstract sciences, should be withheld from the service of the public, even by those who have no professional motives for devoting themselves to it.

2. *Forces acting on a Ship.*

The first consideration that is necessary, for enabling us to judge of the propriety of any arrangement respecting the construction of a ship, is to determine the nature and magnitude of the forces which are to be resisted; and the second, to inquire in what manner the materials can be arranged, so as best to sustain the strains which these forces occasion. The principal forces which act on a ship, are the weight of the whole fabric with its contents, the pressure of the water, the impulse of the wind, and the resistance of the ground or of a rock; and we must endeavour to ascertain the degree in which any of them have a tendency to bend the ship longitudinally or transversely, or to break through any part of her texture; and to inquire into those causes which are likely to promote or to obviate the decay of the substances employed.

3. *Causes of arching. Weight.*

It is unnecessary to explain here the well-known inequality of the distribution of the weight and pressure, which

which causes almost all ships to have a tendency to arch or hog, that is, to become convex upwards, in the direction of their length. It is possible that there may be cases in which a strain of a very different naturé is produced: but in ships of war this tendency appears tó be universal. It is, however, very different in degree in the different parts of a ship; and, of course, still more different according to the different modes of distribution of the ballast and stores which may occur in different ships: but in ordinary cases it will probably be found nearly such as is represented in the calculations subjoined in the note *, deduced from data which have been obligingly

* In a modern 74 gun ship, fitted for sea, the length being 176 feet, the breadth 47½, the forces are thus distributed.

	Feet.	Weight.	Pressure.	Difference.
Aftermost -	49	699	627	72 tons.
Next - - -	20	297	405	—108
	50	1216	1098	118
	20	290	409	—119
	37	498	461	37
	176	3000	3000	00

Now the laws of equilibrium will not allow us to suppose these forces concentrated in the middle of the respective portions, or equally distributed through them; and it becomes necessary, that one of the weights should be situated further forwards; which must be that of the foremost portion, containing the bowsprit and its rigging. It is also natural to suppose the excesses of weight and pressure, distributed with as few abrupt changes as possible, so as to neutralise each other at the common termination of the adjoining portions, and to become more unequal in parts more remote from these neutral points. Thus the excess of weight in the first 49 feet being 72 tons, it may be supposed to begin at the rate of $\frac{144}{49}$ tons per foot, and to diminish gradually and equably, so that its centre of action will be at the distance $\frac{49}{3}$ from the end: the excess of pressure must increase in the next place until at the distance of 59 feet from the stern it becomes $\frac{108}{10}$ per foot, and must then dimi-

furnished by an acute and experienced member of the Navy Board.

Longitudinal Pressure.

To this strain another is added, from a cause, which, although not very inconsiderable, appears hitherto to have escaped notice: that is, the partial pressure of the water in a longitudinal direction, affecting the lower parts of the ship only, and tending to compress and shorten the keel, while it has no immediate action on the upper decks. The pressure, thus applied, must obviously occasion a curvature, if the angles made with the decks by the timbers are supposed to remain unaltered, while the keel is shortened, in the same manner as any soft and thick substance, pressed at one edge between the fingers, will become concave at the part compressed; (Lect. Nat. Phil. I. Pl. 9, F. 117); and this strain, upon the most probable supposition respecting the comparative strength of the upper and lower parts of the ship, must amount to more than one-third as much as the mean value of the former, being equivalent to the effect of a weight of about 1000 tons, acting on a lever of one foot in length, while the strain, arising from the unequal distribution

nish until it vanishes at 69, where the excess of weight must begin to prevail, becoming at 94 $\frac{118}{18}$ per foot, and vanishing at 119. The excess of pressure might then be supposed to increase gradually through the next portion, in order to avoid an abrupt change at its extremity; but this supposition would still be insufficient, and it becomes necessary to imagine that for 6.6 feet the forces remain neutralised, and the pressure then prevails, so that its excess becomes at last $\frac{119}{6.7}=17.7$ per foot: it must then decrease for 17.5 feet, and the excess of weight at the extremity must become 19.7 per foot, the neutral point being at 156.5. The equilibrium of the forces will then be expressed by the equation $72 \times 16.3 - 108 \times 59 + 118 \times 94 - 119 \times 134.5 - 155 \times 144.8 + 198 \times 169.5 = 0$, which is sufficiently accurate for every purpose.

tribution of the weight and the displacement, amounts, where it is greatest, that is, about 37 feet from the head, to 5260, in a 74 gun ship of the usual dimensions; and although the strain is considerably less than this exactly in the middle, and throughout the aftermost half of the length, it is no where converted into a tendency to "sag," or to become concave. It must, however, be remembered, that when arching actually takes place from the operation of these forces, it depends upon the comparative strength of the different parts of the ship and their fastenings, whether the curvature shall vary more or less from the form, which results from the supposition of a uniform resistance throughout the length. An apparent deviation may also arise from the unequal distribution of the weight through the breadth of the ship: thus the keel may actually sag, under the step of the mainmast, even when the strain, as here calculated, indicates a contrary tendency with respect to the curvature of the whole ship.

Force of the Waves.

The magnitude of the strain on the different parts of a ship is subjected to very material alterations, when she is exposed to the forces of the wind and waves. The effect of the wind is generally compensated by a change of the situation of the actual water line, or line of fluitation, so that its amount may be estimated from the temporary or permanent inclination of the ship; and the force of the waves may be more directly calculated from their height and breadth. These two forces can seldom be so applied as to combine their effects, in producing a strain of the same kind in their full extent; it will therefore be sufficient for our purpose to determine the probable amount of the force of the waves, which is more materially concerned in affecting the longitudinal curvature than that

of the wind. As a fair specimen of the greatest strain that is likely to arise from this cause in any common circumstances, we may consider the case of a series of waves twenty feet in height and seventy in breadth; the form being such, that the curvature of the surface may be nearly proportional to the elevation or depression: a single wave might indeed act more perfectly than a continued series; but such a wave can scarcely ever occur singly. We shall then find, upon calculation, that the greatest strain takes place, in a 74 gun ship, at the distance of about eighteen feet from the midships, amounting to about 10,000 tons, at the instant when the ship is in a horizontal position, while, in more common cases, when the waves are narrower the strain will be proportionally smaller and nearer to the extremity. Hence it appears, that the strain produced by the action of the waves may very considerably exceed in magnitude the more permanent forces derived from the ordinary distribution of the weight and pressure, being, according to this statement, nearly three times as great; so that when both strains co-operate, their sum may be equivalent to about 15,000 tons, acting on a lever of one foot, and their difference, in opposite circumstances, to about 5000. There may possibly be cases in which the pressure of the waves produces a still greater effect than this; it may also be observed, that the agitation accompanying it tends to make the fastenings give way much more readily than they would do if an equal force were applied less abruptly. At the same time it is not probable that this strain ever becomes so great as to make the former perfectly inconsiderable in comparison with it, especially if we take into account the uninterrupted continuance of its action: it appears, therefore, to be highly proper that the provision made for counteracting the causes of arching should be greater than

than for obviating the strain in the contrary direction: for example, that if the pieces of timber intended for opposing them were, on account of the nature of their fastenings, or for any other reason, more capable of resisting compression than extension, they should be so placed as to act as shores rather than as ties: although it by no means follows, from the form which the ship assumes after once breaking, that the injury has been occasioned in the first instance by the immediate causes of arching: since, when the fastenings have been loosened by a force of any kind, the ship will naturally give way to the more permanent pressure, which continues to act on her in the state of weakness thus superinduced.

4. *Breaking transversely.*

The pressure of the water against the sides of a ship has also a tendency to produce a curvature in a transverse direction, which is greatly increased by the distribution of the weight, the parts near the sides being the heaviest, while the greatest vertical pressure of the water is in the neighbourhood of the keel. This pressure is often transmitted by the stanchions to the beams, so that they are forced upwards in the middle: when they are unsupported, the beams are more generally depressed in the middle, by the weight of the load which they sustain; while the inequality of the pressure of the water co-operates with other causes in promoting the separation of the sides of the ship from the beams of the upper decks. On the other hand, the weight of the mainmast often prevails partially over that of the sides, so that the keel is forced rather downwards than upwards in the immediate neighbourhood of the midships. The tendency to a transverse curvature is observable, when a ship rests on her side, in the opening of the joints of the planks aloft,

aloft, and in their becoming tighter below; although this effect depends less immediately on the absolute extension and compression of the neighbouring parts than on the alteration of the curvature of the timbers in consequence of the pressure.

5. *Lateral Curvature.*

In such a case there is also an obvious strain tending to produce a lateral curvature; and shores are sometimes employed to prevent its effects, when a ship is "hove down" on her side. This indeed is comparatively a rare occurrence; but when a series of large waves strikes a ship obliquely, they must often act in a similar manner with immense force: the elevation on one side may be precisely opposite to the depression on the other; and the strain from this cause can scarcely be less than the vertical strain already calculated: but its effects are less commonly observed, because we have not the same means of ascertaining the weakness which results from it by the operation of a permanent cause. When a ship possesses a certain degree of flexibility, she may in some measure elude the violence of this force by giving way a little for the short interval occupied by the passage of the wave; but it may be suspected that her sailing in a rough sea must be impaired by such a temporary change of form.

6. *Grounding.*

When a ship takes the ground, she may either give way at once to the stroke of a rock, or rest on a bottom, more or less soft, until she is either wholly or partially abandoned by the water. In the former case, her resistance must depend in great measure on the parts in the immediate neighbourhood of the injury: in the latter it may happen, that she may be supported by so large a surface,

surface, as to be more in danger of parting aloft than of being crippled below. Commonly, however, the floor timbers are forced in at one end, the first futtocks, which are their immediate continuations, being broken off; and sometimes the opposite ends of the floor timbers are forced out, especially in large ships without riders, their attachment to the keel remaining unimpaired.

7. *Decay.*

The causes which promote the decay of timber are only so far understood as we are acquainted by experience with their effects. A partial exposure to moisture appears to be by far the most general of these causes: it is well known that total submersion does not accelerate decay; a surface which is kept moist by imperfect contact with another, so that a portion of water is retained between them by capillary attraction, seems always to be the part at which the timbers begin to rot; while both the surfaces completely exposed either to the drier air or to the water, and those which are wedged closely together, and press strongly against each other, remain perfectly sound.

8. *Means of Resistance.*

We are next to inquire into the comparative advantages of different angular positions of the timbers of a ship for resisting the forces which have been described; and in particular how far the arrangements which have been proposed by Mr. Seppings are better calculated for the purpose than the common modes of construction. Whatever opinion we may ultimately form of these arrangements, they are by no means sufficiently justified by the experiments which have been exhibited in illustration of them. These experiments shew, that when

two

two parallel planks, Figs. 1 and 2, have loose pieces in-

Fig. 1.

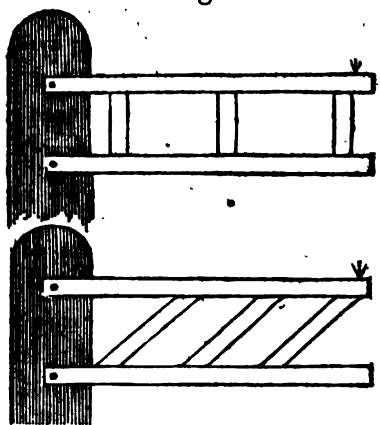
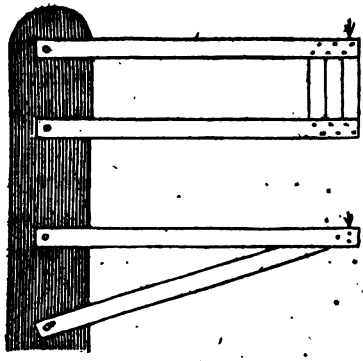


Fig. 2.

terposed, extending perpendicularly from one to the other, they are incomparably weaker, with respect to any transverse force, than when the intermediate pieces are in an oblique direction, so as to constitute a frame, which can only be bent as a whole. But it cannot for a moment be imagined, that the planks of a ship are connected with the timbers in as loose a manner as these transverse braces, which will scarcely support their own weight for the purpose of the experiment; and, in fact, the comparison would have required, that the whole space included by the parallelogram should be filled up in each case by similar braces, or at least that the two planks should have been firmly united at the loose end to the transverse braces, Fig. 3; and it is demonstrable that in this case the same weight would have broken the pins, as if one of the planks had been oblique, or as if the planks had remained parallel, and had been connected by oblique pieces.

Such

Fig. 3.



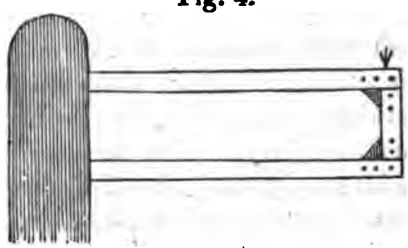
Such a result would, however, be far from proving the inutility of the addition of oblique braces to a rectangular frame: for the kind of strength required for any particular purpose is not always determined by the magnitude of the force which would be capable of breaking the substances concerned, although the power of resisting such a force is properly called strength, in the most limited sense of the term: but there are many occasions on which stiffness or inflexibility is of still greater consequence than strength, and others again on which flexibility is of material advantage. A coach-spring, consisting of ten equal plates, would be rendered ten times as strong if it were united into one mass, and at the same time a hundred times as stiff, bending only one hundredth of an inch with the same weight that would bend it a whole inch in its usual state, although nothing would be gained by the union with respect to the power of resisting a very rapid motion, which I have on another occasion ventured to call resilience. (Lect. Nat. Phil. I. p. 143, II. 50.) Now it appears to be extremely difficult to unite a number of parallel planks so firmly together, by pieces crossing them at right angles, as completely to prevent their slid-

 ing

ing in any degree over each other: and a diagonal brace, of sufficient strength, even if it did not enable the planks to bear a greater strain without giving way, might still be of advantage, in many cases, by diminishing the degree in which the whole structure would bend before it broke.

The strength of a simple rectangular frame, firmly fixed at one end, is rendered somewhat less than double by perfectly fastening the joints at the other, Fig. 4, and the stiffness is nearly quadrupled.

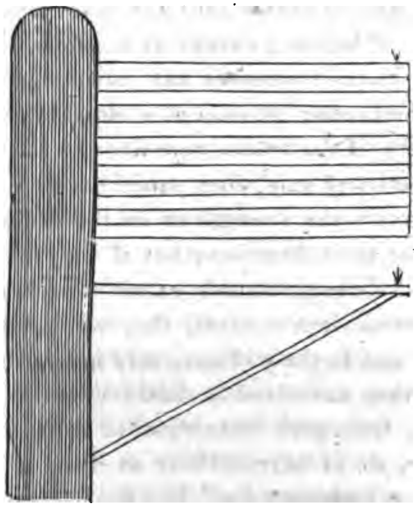
Fig. 4.



The comparative security obtained by the addition of a diagonal brace is almost without limit. Supposing any number of planks, of equal dimensions, to lie simply on each other without any adhesion, and to be firmly fixed at one end, their aggregate strength will be very little greater than that of a single plank, of one sixth part of the common depth or thickness of each, supported by a brace a little stronger, in the direction of the diagonal of the whole, Fig. 5; and the stiffness of the parallel planks will be as many times less than that of such a frame, as there are planks in one-third of the whole series. Thus, if we had twelve planks, six inches deep and one thick, with friction rollers interposed, it is demonstrably true, however surprising, that they would be very little stronger in supporting a weight at the end than a single tie an inch

inch square in its section, assisted by a diagonal brace of equal relative strength: and also, that this apparently slight structure would be nearly four times as stiff as the twelve planks, being depressed only one-fourth as much, with a given weight, as the planks with a similar force acting on them.

Fig. 5.

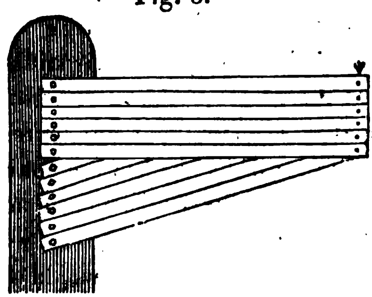


It is well known, that if the planks were firmly united into one mass, their strength would be rendered twelve times as great by the union, and their stiffness 144 times: but this is not the greatest resistance of which the materials are capable, even without any extension of their base of support; for if the planks were connected in pairs at half the distance of the whole depth, and allowed to move freely round fastenings perfectly secure, their strength, speaking theoretically, would be greater by nearly one half than if they formed a compact mass, while their stiffness would be only about one-fourth as great: and an effect, nearly similar, might be produced

 if

if the respective pairs were united by oblique braces, extending over half the depth of the whole structure, although it would be very difficult in practice to make the strength of an arrangement of this kind, even equal to that of a compact mass, since the fastenings could never be so perfect, as to bring every fibre of each plank into its full action at once, as the theory supposes. If the planks were already united into a conpact mass, so as to be incapable of bending except as a whole, it is of importance to inquire whether any advantage would be gained by the further addition of oblique braces: and it will appear that if the braces were fixed to the outermost planks of the series only, they would have no manner of effect, either on the strength or on the stiffness, whatever might be their direction; but if they were sufficiently fastened throughout their extent to each plank with which they come into contact, they would add both to the strength and to the stiffness, very nearly in the same degree as if they were fixed in the direction of the planks, at a distance from each other equal to their shortest actual distance, so as to constitute as many ribs as there are braces in a transverse line, Fig. 6. Hence, although

Fig. 6.



there is obviously no economy in such an employment of oblique braces, yet it is by no means true that oblique braces

braces are incapable of adding to the strength of a structure composed of pieces arranged at right angles; the assertion might, however, be very nearly correct in circumstances approaching to those of one of the experiments which have been exhibited for the purpose of illustrating the utility of such braces. On the other hand, the advantage of employing oblique braces must depend in great measure on the degree in which the angular position of the structure would be susceptible of variation without them; since, when properly fastened, they must universally tend to preserve the form unaltered, although they are somewhat less calculated to add to the ultimate strength of the principal tie or shore, than if their direction had been longitudinal. To take, for example, the case of a ship's arching or hogging: if the strength were overcome without any deficiency of stiffness, the upper decks and wales would be elongated, and the butts of the planks aloft parted, while the keel would be somewhat shortened, and the planks near it crippled, so that a ship 176 feet long and forty feet deep, arching one foot with a uniform curvature, would have the length of the parts aloft, on the level of the quarter deck, twenty-two inches greater than that of the keel. If, on the contrary, the strength were not overcome, but the stiffness only failed, the angular situation of the parts being altered, and the joints simply becoming loose without parting, the planks would slide on each other, and their square ends would no longer remain in the same vertical line at the ports, while there would be no material alteration in the comparative length of the decks and keel, nor any permament parting of the butts of the planks.

TO BE CONCLUDED IN OUR NEXT.

On

On the Cultivation of French Pears in Scotland, and on the best Means of bringing into a bearing State full-grown Fruit Trees; especially some of the finer Sorts of French Pears. By Mr. James Smith, *Gardener to the Right Hon. the Earl of Hopetoun, Ormiston Hall.*

From the Transactions of the Caledonian Horticultural Society.

That the finer sorts of French pears cultivated in Scotland in general yield but a very precarious crop, is well known to every experienced gardener. Many elegant gardens have been made, and expensive walls built, with very little satisfaction, either to the proprietor or person that superintended them, especially in cultivating the finer sorts of French pears. How often is the table loaded with a profusion of fruit in the latter part of summer and the autumn months, but left with a very scanty supply in winter and spring, and frequently destitute of any. That there are a few places in this country that have a tolerable supply is an undeniable fact; but, it is evident, that a wide field is left open for the more effectual cultivation and improvement of the finer sorts of French pears. To attain these important ends, and in some measure to afford the information required by the Caledonian Horticultural Society, is the object of the following remarks "on the best means of bringing into "a bearing state full grown fruit trees, especially some "of the finer sorts of French pears, which, though apparently in a very healthy and luxuriant condition, are "yet in a state of almost total barrenness."

Keeping these ends in view, it will be necessary, in the *first* place, to point out the cause of failure in cultivating the finer sorts of French pears; *secondly*, the remedies to prevent the failure so generally complained of; and, *thirdly*,

thirdly, the means for bringing full grown pear trees into a bearing state.

Before proceeding farther, it may be necessary to observe, that the cultivation of French pears in this northern climate should not be attempted without walls, especially the finer sorts, which require the utmost care and attention to bring them to perfection. The following remarks will, therefore, be entirely confined to the cultivation of that so much esteemed fruit on walls.

Cause of Failure of the finer Sorts of French Pears.

The cause of failure in the cultivation of the finer sorts of French pears may either proceed from want of climate, improper soil, or injudicious pruning and training.

From want of climate, gardens placed in high, cold, and late situations, are very improper for the finer sorts of French pears. If the soil be moderately good, the trees may grow with apparent luxuriancy, but in these bleak and elevated places the spring is late; the summer in general cold, and of short duration: there is a want of mild weather in the autumn, so requisite for ripening the fruit-buds for the succeeding season: the wood, indeed, may be so far ripened as to stand the severity of the winter, and in the spring shew a few weak blossoms; but these never set kindly, and frequently end in total barrenness. The want of climate is often increased by placing trees on improper aspects, where sometimes the scanty crops may swell to a tolerable size; but after keeping the fruit some time, it gets shrivelled and hard, little superior in taste to the wood of the tree it grew upon. For many seasons the crop will entirely fail, and still the trees may apparently be in a very healthy and luxuriant condition, although in a state of almost total barrenness.

But

But the cause of failure may proceed from improper soil. Thin gravel, sterile sand or stiff clay, are equally pernicious to the finer sorts of French pears. On thin gravel, the trees may grow pretty freely; but the fruit will be small, hard, cracked, and of little or no value. On poor sandy soil the fruit is little better, because it does not receive proper nourishment. On stiff clay the trees may make tolerable progress, and shew a considerable quantity of blossom; but the fruit is generally kernelly, and ill shaped, and very inferior in quality. When the subsoil is of any bad quality, as cankering irony gravel, corrosive sand, or wet spongy clay, means must be used to make a bottom to the fruit tree borders more congenial to the finer sorts of French pears. Such soils, or sub-soils, naturally point out the evil, with the necessity of applying a proper remedy. The soil that requires more particular attention, is that which may be termed tolerably good; such a one I have had occasion to be concerned with; it was moderately good, almost three feet deep, over a bottom of dry clay. In ordinary seasons, the trees bore pretty fair crops of good quality, but in wet seasons the fruit did not ripen, and the following spring the scanty blossoms seldom set into fruit, owing to a superabundance of moisture in the border, occasioned by the neighbouring ground having an almost imperceptible declivity that way; and the foundation of the wall being sunk a few inches into the clay, increased the retention. Even on rich black loamy soils, in low situations, with a retentive bottom, the trees are very liable to barrenness, although apparently in a healthy condition.

Again, the cause of failure may proceed from improper pruning and training. Severe injudicious pruning in any of the kinds of fruit trees is very prejudicial to their

bearing,

bearing, and to none more so than the finer sorts of French pears, which in good soil are naturally inclined to grow luxuriantly. When trees are not planted at a proper distance, the branches soon come in contact with other trees; their extremities are rendered weak, and their vigour is exhausted by producing luxuriant breast-wood. Many trees are neglected for the most part of the summer season, without taking off the breast-wood, or nailing in the young shoots; and some of them, neglected from one winter dressing until another, are often treated with contempt, and considered as hard, useless, and insignificant fruit, and obliged to give way to fruit of an inferior kind; while the very evil complained of is augmented by that indifference with which they are treated. If they undergo a dressing in the autumn months, stumps are frequently left from half an inch to two inches long, which next season produce two shoots for one: hence their luxuriancy is increased, their breast-wood becomes a mere thicket, intercepting the influence of the sun, air, and refreshing showers, robbing the fruit spurs of their proper nourishment, drawing them out in a weakly state, which renders them almost useless, and the trees become a receptacle to insects and other vermin. It may as well be expected, that a hedge which annually undergoes the operation of the shears or pruning-hook will bear a crop of seed, as that trees under such management will bear a crop of good fruit; yet such trees will be in a very luxuriant condition, though in a state of almost total barrenness.

Remedies to prevent the Failure so generally complained of in cultivating the finer Sorts of French Pears.

When the cause of failure proceeds from want of climate, as will frequently happen in high, cold, and late

 places,

places, in such situations it would be highly improper to plant the Colmar, Virgouleuse, Chaumontelle, Winter Bon-chretien, or other fine late pears: to supply their place, some of the best autumn pears should be planted on the best aspects, such as the Autumn Bergamot, Muirfowl Egg, Swan Egg, &c. They will be longer in ripening than in warmer situations, and of course keep longer for a supply to the table. Where the climate is less bleak the Chatalonne Bergamotte, Green Sugar, and Brown Beurré, may be planted. In moderate situations the Crasanne and St. Germain will succeed well. Where the situation is good, the other fine late pears should be planted, allowing them the best aspects, otherwise little good can be expected from them, even in the most favourable situations in this country.

If the cause of failure proceeds from improper soil, it will be necessary to remove it at least three feet deep, the whole breadth of the border; when the subsoil should be carefully examined, and if it is of any bad quality, an impenetrable bottom must be made with a considerable declivity towards the walk in front of the border. Another consideration of importance, which requires particular attention, is, that a border, situated on a plain with a retentive subsoil, requires a different treatment from that placed on a declivity where the soil is permeable. In the former case, a good drain must be made in front next the walk, deeper than the bottom of the border, to receive the superabundant moisture. It may be necessary, when the adjacent ground has a declivity towards the border, to make another drain on the outside of the walk, to receive the water before it approaches the border. In the latter case, where the soil is permeable on a declivity, draining will be unnecessary; but as it is of such utility in cultivating French pears to have a dry bottom, drain-

ing

ing should never be dispensed with when there is the least risk of injuring the trees or the fruit by neglecting it.

Having removed the inconveniences of a pernicious subsoil, and secured a dry bottom, the border should be made up with soil prepared for that purpose. When the situation is low, and naturally retentive, I would prefer a hazely coloured loam, taken from banks or the borders of fields which remain unbroken by the plough. When the situation is on a declivity with a permeable bottom, strong loam is to be preferred: the most desirable is that taken from old pasture on the top of a clay soil. In either case, the more turf that can be got so much the better; but it will be of considerable advantage to lay the soil up for some months before it be used, to be meliorated by the sun and air, and to rot the turf, turning it over at times, adding a quantity of good rotten dung, (preferring old hot-bed dung, as more latitude can be used with it, owing to its exhausted state,) breaking the turf, and blending the soil and dung well together in the operation of turning. When the soil is light loam, and not of any bad quality, it may only be necessary to remove a portion, and replace it with strong loam. In very stiff soil light loam will be of considerable advantage. In all cases where wall trees are to be renewed, the borders should always be trenched over, adding what new soil and manure may be necessary, which should be regulated according to the nature of the soil, or other local circumstances.

Some years ago, having occasion to renew a considerable extent of wall with young trees, I was under the necessity of deviating from the above method, owing to the means being put out of my power, and the work requiring to be done without loss of time. The method I

 took

took was this: after removing the old soil three feet deep, a quantity of strong loam, well mixed with dung, was put where each tree was to be planted, (about a yard in diameter,) the intervals between the trees, and for a considerable extent in front of the wall, were filled up with fresh turfs, packed one above another, to the ordinary level of the ground, and laid over with a few inches of soil, to make the surface level, and prevent the grass from rising. The border was trenched over the succeeding season, and a quantity of manure broke in amongst the turf; care was taken not to injure the roots of the young trees. The effect has been truly astonishing: the trees are in the most thriving condition, and bear crops of excellent fruit.—Although the above method has fully answered every expectation, and the trees are at present standing as an ocular demonstration, I would by no means recommend it in preference to the other, where a choice is left.

Regular pruning and training is likewise of great importance in the cultivation of the finer sorts of French pears. When planted, they should always be allowed proper room for extending their branches, to exhaust their luxuriancy; the trees should be particularly attended to in the summer months, frequently looking them over, displacing all foreright and superfluous shoots, pinching them off with the finger and thumb, leaving the spurs about two inches long on the last year's wood; yet it may be necessary in some cases to rub them off close, when care should be taken to injure the bark as little as possible. By these means the trees will be kept in a regular state, and enjoy the benefit of the sun and air; the leading branches will receive more nourishment, the young wood and fruit spurs will be more properly ripened for insuring a crop of fruit the succeeding season, and a great

great deal of that severe pruning will be avoided, which is practised on neglected trees in the autumn and winter dressing. The knife should be used as little as possible, and only where it cannot be avoided, for shortening the branches, for a supply of young wood, where it is necessary, and thinning out any useless and worn out spurs, or fully retrenching any of the shoots that were shortened in summer, which are not likely to set into fruit spurs, with any damaged or worn out branches. The trees should be regularly trained to the walls in the summer months, as they advance in growth, and undergo a proper regulation annually in the winter or spring, whether they are trained horizontally, fan, half-fan, upright, or pendulous.

Much has been said both in favour of horizontal and fan training; but the method I generally practise is different from both, or rather a medium betwixt the two; and, from experience, I have always found it attended with good success. In the spring after the young trees are planted, and at the time the buds begin to burst, the branches are headed down to four or five eyes; and in summer two or three shoots are trained from each branch in a regular manner, laying the first on each side horizontally at the bottom of the wall, and filling up the middle in form of a fan. The following winter the young branches are cut back about one-half, less or more, according to the strength of the tree, training two or three shoots from each the succeeding summer. By the third season, if all has gone on well the trees will have made considerable progress. In the winter training, the trees should be carefully examined: beginning at the bottom of the wall, lay the first branch on each side horizontally, at full length, proceeding upwards at the distance of from eight to twelve inches, according to the size of the wood, foliage,

and

and fruit. Train the remaining branches likewise at full length, making them rise in a circular direction from the centre of the tree, until they are at the distance above specified; and then train them horizontally. When the branches are too much crowded, retrench the weakest, reserving four or five in the centre, which are to be cut back, and trained in the fan form; and from these, two or three shoots may be allowed to rise. By this means four or five pair of branches will be added to the height of the tree, which are to be trained in the same circular manner as before, until they arrive at width enough for taking the horizontal direction. The centre branches are to be shortened, as in the preceding winter, and so on, until the tree approaches the top, and you leave remaining only what shoots may be necessary to fill the wall. The upper branches take only a gentle curve before they are laid horizontal, to prevent the wall from having a naked appearance at the centre towards the top of the tree: allowing the next pair of branches below to have a longer curve, but not so much as to make it disagreeable to the eye. Trees trained in this manner seem less subject to luxuriancy than those trained in most other methods: the strength being more equally divided amongst the branches, the wall is generally filled in a very few years, and the trees are sooner brought to a state of bearing.

The Means for bringing full-grown Pear Trees into a bearing State.

As the barrenness of full-grown pear trees proceeds from different causes, owing either to their local situation or former manner of treatment, it will be of great importance, before the application of any remedy, to ascertain the cause from whence the unfruitfulness proceeds, which may be from one or more of the circum-

stances

stances already mentioned, under the head of the cause of failure of the finer sorts of French pears.

When the barrenness of full-grown pear trees proceeds from want of climate, they must either be cut back and grafted with some other sorts that will ripen properly, or be entirely removed, to give place to others more suitable to the situation. But as grafting is of such importance, and the only means to bring full-grown trees into a state of bearing in such a situation, it should never be omitted, as by putting grafts on the branches the wall will be covered, and the trees brought to a bearing state, in one-third of the time required to rear young plants. I have frequently fonnd the flavour of fruit much improved by grafting on old trees; and they seldom fail of producing a good crop.

With respect to luxuriant trees placed on improper aspects, I have ever found, that the best remedy applicable in such cases, where the sorts were to be preserved, (even on trees of considerable magnitude,) is to have them carefully taken up and removed to more proper situations. The effect of such treatment is of considerable advantage, as it checks the luxuriancy, and brings the trees into a full bearing state in a short time. Where such trees are not wanted they should be cut back and grafted, as in the case of want of climate.

When the climate and aspect are good, the barrenness must either proceed from the soil or manner of pruning and training.

When the soil is of a stiff quality, with a retentive bottom, proper draining will be essentially necessary to carry off the superabundant moisture; the border should be trenched, removing any pernicious soil, adding a proportion of good loam and manure, which should be stronger or lighter, according as the nature of the original soil or

the

the situation requires; at the same time the roots of the trees should be considerably shortened, and this should be done in a neat manner, with a gentle slope from the under side, to prevent any wetness from lodging on the wound. If any of the principal roots run right downward, every method ought to be adopted that can be used with propriety, to get them removed. By these means the luxuriant shoots will be checked, and turned into fruit spurs; the roots will put forth anew into the kindly soil, and the benefit will soon appear evident, by the fruitfulness of the trees. When the soil is inclined to gravel or sand a considerable quantity of strong loam and manure should be added, the want of which is easily perceptible in the fruit being small and hard; although when, on such soils, I have found very luxuriant trees in a state of almost total barrenness, it was more to be ascribed to improper pruning than to the nature of the soil.

When the barrenness proceeds from improper training or pruning, different remedies will be necessary, according as the various cases require. In some cases, where the trees are too much crowded, the inferior ones must be cleared away, to give place to the principals to extend their branches, and exhaust their luxuriancy. But, frequently, when the trees are allowed to remain crowded for any length of time, the extremities of the branches become weak, and seldom grow freely; it will therefore be necessary to shorten back the branches to the first well-placed shoots, which should be trained to the wall as leaders; or, where such shoots cannot be found, cut back the branches to some bud or joint that has the appearance of putting forth good shoots to be trained for leaders to the branches, and in summer the breast-wood should be carefully removed from time to time,

time, that the trees may reap the benefit of the sun, air, and refreshing showers.

When any trees are wanted, if the situation is good, and the sort suitable, some of these crowded trees may be replanted with safety, if not too old. I have frequently removed trees that were extended twenty-four feet, by eighteen high; some of them were carried several miles, and are now doing well, and in a full bearing state, although they were formerly in a very luxuriant condition, and in a state of almost total barrenness.

When full-grown pear trees are allowed to exhaust themselves in luxuriant breast wood, the case is very bad indeed, and requires a severe operation to remedy the evil, which must generally be applied to both branches and roots. Some, that are not too far gone, may be remedied by shortening the roots properly, and pruning off the stubs from whence the luxuriant breast wood proceeds, retaining every part that has the appearance of setting into fruit spurs; and by attending to the removal of the breast wood in the summer months, the trees will be brought to a bearing state.

When trees are so far gone that they cannot be treated in the above manner with any prospect of success, the next remedy is to cut the trees down, and train them anew. The cutting should be regulated according to circumstances, as in some it may be convenient to cut them, during the latter part of winter, or in the spring months, to within a little of where they were originally grafted. Others may be left to a greater length, but in all cases it will be necessary to apply some soft paste, that will adhere to the wounds to exclude the external air, and prevent any water from lodging and rotting the tree. The following summer the trees should be carefully attended

tended to, displacing all superfluous shoots, training a sufficient quantity to the wall, and nailing them in from time to time, as they advance in growth. Trees renewed in this manner fill the walls in a very short time; and when judiciously managed, seldom fail of producing good crops of excellent fruit. I cut a Cresan pear tree down in the above manner on the 5th of May 1804; it now covers a wall sixteen feet high, and is at present (August 1810) twenty-eight feet betwixt the extremities of the branches, and in a full bearing state.

When trees undergo any of the above operations it will be necessary to pay attention to the borders, adding what new soil or manure may be necessary, examining the roots of the trees, and shortening them as the nature of the case may require.

Thus may full grown pear trees be brought to a bearing state in a short time, although barren, in the utmost state of luxuriance. When the trees are free of canker they should not be grubbed up unless in the very last extremity, as by proper attention to climate and situation there are few cases that may not be remedied if treated in a judicious manner.

The four following pears, although not ranked among French pears, are found particularly useful on walls, especially in high situations in Scotland, where the other finer sorts do not ripen properly: Green Yair, Muirfowl Egg, Swan's Egg, and Winter Auchan. It may, however, be remarked of the Muirfowl Egg and Winter Auchan, that when planted as standards they produce not only better crops but fruit of a higher flavour.

On

On the Destruction of the Gooseberry Caterpillars, and the Worms which infest Carrots and Onions.

By Mr. John Mackray, *Gardener at Errol House.*

From the Transactions of the Caledonian Horticultural Society.

1. *Gooseberry Caterpillars.*

Much has been said respecting the destruction of the gooseberry caterpillars, and various devices, which have proved more or less successful, have been tried.

About nine years ago, when I came to Errol, I found these vermin very formidable, and making vast havock among the leaves of my gooseberry plants. I procured some tobacco and soft or black soap, and I boiled a quarter of a pound of tobacco with one pound of soft soap in about eighteen Scots pints of water, and kept stirring the liquid while boiling with a whisk, in order to dissolve the soap: this liquor when milk-warm, or so cool as not to hurt the foliage, I applied to the bushes with a hand squirt in the evening, and in the morning I found all the ground under the bushes covered over with dead caterpillars. I partly attribute the success of this wash to the tenacious quality of the soap, which adheres to the leaves longer and closer than tobacco juice alone would do: this practice I continued for six years, always when I saw any symptoms of the approach of caterpillars. I found them to diminish considerably every season, and for the three last years I have not seen any appearance of them in the garden. I judge from this, that the liquor must have either destroyed the eggs of the insect, or they must have been killed before having time

to deposit their eggs. It may be right to remark, that the liquor has no bad effects on the foliage of the plants.

2. *Worm in Carrot and Onions.*

Garden-ground in general, being successively cropped with vegetables very near a-kin in nature to each other, and from the frequent application of manure soon becomes a receptacle for worms, maggots, and other vermin, which prove destructive to the roots of carrots, onions, cauliflower, and other tender vegetables, from which they are always free in new soils, or ground that has never been cropped before with such vegetables. The garden-ground at Errol has been occupied as a garden for upwards of a century, and consequently is subject, in common with other old gardens, to the attacks of several species of vermin. This first induced me to try to remove this evil by a *rotation of cropping*; and the most rational method that presented itself was, to follow strawberries that had been four or five years planted with onions, and artichokes that had stood the same time, with carrots; for the caterpillars do not choose to attack either the strawberry or artichoke. This plan I found to succeed, and I have now regularly practised it with uniform success for nine years.

In order to enable me to do this, I have planted a succession of strawberries and artichokes annually; for which trouble I have found myself amply repaid, by larger and more regular crops of strawberries than could have been expected, had the same plants been allowed to remain for eight or ten years, as is sometimes practised; and I have always had a succession of artichokes from my young plants in November, after my old plants had done bearing. In some cases it may be safe to crop thrice

with

with onions or carrots in the same spot, but not oftener, as some symptoms of the worm and maggot generally appear the second or third year; but from the ground being four or five years under strawberries or artichokes, plants on which those vermin cannot subsist, they soon perish, and the ground where the rows stood has all the advantage of a new soil.

Soot applied as a manure is a good preventive of the maggot in onions, but it rarely happens that a sufficient quantity can be procured for that purpose: shallots, however, from requiring only a small spot, may be much improved in growth, and entirely preserved from maggot, by applying old hot-bed dung as manure, in the bottom of the drills, well mixed with soot; on this mixture plant the shallots, and cover to a proper depth. The soot prevents the appearance of the maggot, and at the same time greatly improves the strength of the shallots: I have never found this plan fail.

Cauliflower and broccoli roots may be preserved from the effects of worms by watering the drills well with soap-suds before planting, and occasionally afterwards; this not only prevents the worm, but encourages the growth of the plants, and in some measure prepares the ground for other vegetables subject to the same sort of attack.

Note on the Use of the Flour of the Phalaris Canariensis, *for sizing Muslins and other Stuffs.*

By M. Marcel de Serres.

From the Annales des Arts et Manufactures.

It is not long since the use of the seed of the *Phalaris Canariensis* in the arts was discovered; but experiments made by the direction of the Prussian government have ascertained, that the flour of that seed may be employed as size by weavers.

The flour obtained by the trituration of the seed of the *Phalaris Canariensis* is used in the same manner as that of wheat. It has this advantage over the latter, that it renders the warp softer, and keeps it damp longer. These two circumstances are extremely favourable for the fabrication of fine cottons, as well as for that of muslins, cambrics, and in general for all stuffs, the warp of which is very close, on account of the fineness of the threads. The flour of the *Phalaris Canariensis* is extremely soft and glutinous; and it is probably on account of the great quantity of gluten it contains, that it sizes better those warps that are put into a solution of it. It likewise possesses the advantage of rendering stuffs more equal and uniform. The flour of the *Phalaris* may be used a few days after its preparation, whereas the size made of wheat-flour must ferment a considerable time at certain seasons, especially in winter. The quantity of flour of either kind to be employed is nearly equal. Though their prices are very different, that difference is amply compensated by the advantages afforded by that of the *Phalaris* for the sizing of fine stuffs. This plant is, besides,

sides, now become very common throughout almost all Europe, and it is remarkable for the promptitude with which it is propagated. It was, therefore, necessary to find a use for a plant which grows with equal facility in every latitude.

From experiments made upon a very large scale, in various manufactories at Erfurt and in Prussia, it appears that the flour of the *Phalaris Canariensis* is preferable to the finest wheat-flour for the sizing of fine stuffs, because it imparts a high degree of softness and suppleness to the threads, and a dampness favourable to their flexibility. As the gluten of the flour of the *Phalaris* has much affinity with water, it keeps the threads damp for a much longer time than wheat-flour, and this renders them fitter for working. It is well known that threads when dry are apt to break, and that especially in summer this circumstance gives a great deal of trouble to weavers: it is for this reason also that they place their looms in subterraneous places. It was of great importance to find a remedy for this inconvenience, and herein consists one of the great advantages of the flour of the *Phalaris*.

Preparation of a solid Varnish for preserving Iron from Rust.

From the ANNALES DES ARTS ET MANUFACTURES.

OXYDATION is one of the greatest inconveniencies to which certain metals are liable. Wrought iron, for instance, corrodes in a short time when exposed to damp or to acid vapours, and a substitute has therefore been sought for it, for various purposes, in cast iron, which is not so easily oxydated, but which has not the ductility of the other. Expedients, more or less efficacious, have been proposed for preserving iron from rust. It is generally covered with a varnish capable of withstanding the influence of the atmosphere. In order that this varnish may fulfil the conditions required, it ought to be so elastic as not to scale off, and so adhesive as not to leave any spot uncovered. The English have tried a composition of this kind, the secret of which we have not yet learned.

In France a patent for fifteen years was granted on the 26th of September 1791 to Madame Leroi de Jaucourt, for a metallic varnish, for preserving metals from rust. It is composed of five pounds of tin, eight ounces of zinc, eight ounces of bismuth, eight ounces of copper, and eight ounces of saltpetre. These metals mix in such a manner that the metal resulting from them is hard, white, and sonorous. The small proportion of copper introduced into the composition produces no verdigris.

The articles to be covered with this coating are to be heated only in the matter itself, melted in pans of plate iron. When sufficiently heated they are taken out, and sal ammonia is strewed over them: covered with this salt,

salt, they are quickly plunged into the composition; they are then wiped with tow or cotton, as is done in common tinning, and the part coated is immediately dipped in water.

Iron nails and pins were formerly used to fasten the sheets of copper upon the bottoms of ships; but since it has been ascertained that the Galvanic action produced by the union of those two metals is a cause of destruction, copper nails and pins, which, though not so strong, are not attended with the same inconveniencies, have been employed in their stead. A method has, however, been devised for covering iron nails with a varnish so adhesive that they may be used without danger for lining ships. Cast iron nails were proposed for the same purpose, but soon given up, because they were found very liable to break if care be not taken to strike them exactly in a perpendicular direction.

A method equally simple and advantageous for preserving iron from rust is to heat the metal red hot, and to rub it in that state with wax. After it is grown cold, you remark that all the pores of the iron are completely filled, and that this kind of coating is extremely uniform; but as it is applicable only to articles of small dimensions, it still remained a desideratum to discover a varnish which might be used cold, and which would resist the combined action of the air and of acid vapours.

M. Lampadius, professor of chemistry at Freyberg in Saxony, seems to have resolved this interesting problem. Having remarked that the sulphureous and acid vapours which rise from the furnaces for grilling ores, destroy in a short time the ordinary varnishes, and attack metals used in the construction of buildings, he studied to discover a coating which would preserve them from rust.

As it was necessary to oppose to the acids a matter which they could not dissolve, he tried two metallic oxyds, already saturated with acids, and which, by their desiccative quality, are well adapted for the composition of varnish. Success crowned his attempts, and an experience of six years has sufficiently demonstrated the utility of this menstruum.

M. Lampadius employed for this purpose sulphated lead and sulphated zinc, or vitriol of zinc. The former is prepared by mixing a solution of four ounces of acetate of lead in twelve ounces of water, with a solution of seven ounces of sulphate of soda in fourteen ounces of water. The precipitate obtained by this mixture is sulphated lead, which is filtered, edulcorated and dried.

Sulphated zinc is sold by all chemists and druggists by the name of white vitriol of zinc.

The method of preparing the varnish is as follows:— Reduce to an impalpable powder one ounce of plumbago, or anthracite, with which mix four ounces of sulphated lead, and one ounce of sulphated zinc, and add to it, by degrees, one pound of varnish, prepared with linseed oil, previously heated to ebullition. This varnish dries quickly, and perfectly preserves from oxydation the metals upon which it is laid. It has been employed with success to cover lightning-conductors, and answers equally well for roofs covered with lead, iron, copper, or zinc, which are continually exposed to the action of damp and of acid vapours.

On

On the Distillation of Brandy from Potatoes in Sweden and Denmark.

From Hermbstädt's Museum.

In the last ten years considerable attention has been paid to the distillation of spirit from potatoes in Germany, where the importance of the subject was clearly perceived; but the inhabitants of other countries have not been less solicitous to give greater perfection to this branch of industry, in regard to the materials employed. Thus in the Scandinavian regions, Sweden and Norway, which are deficient in corn, many attempts have been made to produce brandy, which cannot there be dispensed with so well as in the South, in considerable quantity from potatoes. The following particulars, extracted from a pamphlet by M. Brisman, are worthy of notice; as the author communicates in that publication the results of his experience, during a period of twenty years. His farm is situated in the district of Skanderborg; the soil is sandy, and produced very little, till he began, many years since, to cultivate potatoes as a principal crop, though only a sufficient quantity for domestic consumption had previously been raised in the garden. He found, that fifty tons of potatoes might be considered as the average crop *per ton* of land, which is equivalent to about eighty-six Berlin bushels *per* Magdeburg acre. Before the potatoes are taken up he mows the halm some inches above the surface of the ground, and gives it to the cows, which are asserted to yield in consequence more milk, and of richer quality, than when fed with hay. He has made experiments on the produce of potatoes in different species of soils, and with various kinds of manures; but these may be omitted, as irrele-

vant to the present subject. After detailing the advantages of his new system of agriculture over that which he had previously pursued, the author remarks, that the cultivation of potatoes is carried on upon a small scale only so long as they are used for food for man alone. Owing to the difficulty of preserving potatoes during the winter in so cold a climate as that of Sweden and Norway, most of those which are left in spring cannot be applied to any other purpose than as food for pigs. Brisman, therefore, employed potatoes for distillation. To this end the potatoes are boiled, mashed, and mixed with a certain proportion of rye or malt: without any addition, at least of malt, he endeavoured, but in vain, to use them with advantage for distillation. In this manner he produces seven Swedish cans from one ton of potatoes, exclusively of the addition of corn, or at the rate of $5\frac{2}{5}$ Berlin quarts of brandy, *per* Berlin bushel of potatoes. He found that frosted potatoes yielded a spirit of as good quality as sound ones: a remark which, however, does not correspond with the experience of other establishments. Among other instances I shall only cite the following. Being upon a visit to Baron von Arnim, at Neuensund, in the Ukermark, he told me that frosted potatoes had been used some years before in his great distillery; that the quantity of spirit obtained from them was nearly equal to that yielded by sound roots, but the brandy had a very unpleasant intoxicating quality, producing head-ache and illness, even when taken in very small portions. Brisman farther states, that he has also used potatoes which have been frosted, thawed, and to all appearance absolutely spoiled, for distillation; and that they have yielded good brandy, but only in the proportion of six cans *per* ton of potatoes, or $4\frac{22}{35}$ quarts to 1 bushel, Berlin measure. Should this statement be con-

firmed,

firmed, the discovery would be highly important to those Northern countries where it very frequently happens that part of the winter stock of these useful roots becomes frozen. According to Brisman's calculations, the can of potatoe brandy can be sold with greater advantage at 28 schillings than the can of corn brandy at 33: and, according to his experiments, a ton of land sown with rye produces about eighty-nine cans of brandy, whereas the same area planted with potatoes yields about 361 cans. Potatoe brandy, if we may be believe him, is quite as good as that distilled from grain, and the notion that the former loses by long standing is totally erroneous. He has made experiments with both kinds, and left them upwards of two years in the casks. The loss of both is equal, but then they both gain alike by it in quality. The potatoe-wash is very good food for cattle, especially hogs; and, according to Brisman, it has not the same injurious effect upon animals as other wash, which loosens the teeth.

M. Richerström, of Blekingen, in his "Treatise on the Succession of Crops," published at Stockholm in 1809, says, that the inhabitants of the province of Blekingen distil seven-eighths of the brandy made there from potatoes. They supply with it not only the internal consumption of the province, but also the orders from the sea-ports of that district, as well as the whole fleet of men of war at Carlscrona.

In the winter of 1809-10 the Commercial Assessor Uldall, to whom the superintendence of the royal distilleries at Copenhagen was committed, made numerous experiments upon potatoes. He employed for this purpose yellow middling-sized potatoes: he procured these roots from various parts of the kingdom, and found that those which had grown in a sour turfy soil yielded less spirit by one-sixth, or more, than those which had been raised

on

on a light soil and high situations. Without the addition of corn, Uldall could never succeed in throwing the mash into a gradual regular fermentation, and consequently it was impossible to make good brandy from it; but mixed with one-fifth of corn, that is to say, reckoning according to weight, adding to five pounds of raw potatoes one-third of a pound of barley malt and two-thirds of a pound of wheat, the mash fermented extremely well, and the spirit distilled from it had a pure flavour. One distillation requires six tons, or 1152 pounds, of potatoes, 144 pounds of wheat, and eighty pounds of malt, which yield upon an average 154 Danish pots, or 130 Berlin quarts, of brandy, of the strength of six or seven degrees. Experiments with potatoes and with grain alone prove that the distillation of the former, even here, where fuel is so very dear, and a considerable quantity is required to boil the potatoes, leaves 20 *per cent.* more profit. The practice of distilling from potatoes has, therefore, gained ground, and been adopted in many places; but, according to the present arrangements in Denmark, by which distilleries cannot be established except in towns, it is impossible for this method to make such rapid progress as if the inhabitants of the country also were permitted to engage in this branch of industry. The potatoe brandy made here, when distilled with care, has a sweeter taste than the ordinary corn brandy; and it is naturally less heady, especially when the potatoes have been boiled by steam. According to the experiments here collected, potatoes which are sprouted and grown yield as much and as good brandy as others; nay, it may even be theoretically asserted, that sprouted potatoes, which have already shot out fibres for roots, must yield a better spirit, because they are thereby freed from part of the gluten, which is prejudicial to the distillation of brandy.

brandy. Care must only be taken to prevent them from becoming mouldy, for in that case the spirit produced from them acquires a very disagreeable flavour. The refuse is as serviceable for cattle, especially milch cows, as the grains from barley, malt, rye, wheat, or any other species of corn.

List of Patents for Inventions, &c.

(Continued from Page 191.)

WILLIAM MADELEY, in the parish of Yardley, Worcestershire, Farmer; for an improved drilling machine, for drilling beans, turnips, pease, pulse, corn, and seeds of every description. Dated July 27, 1815.

DAVID MUSHET, of Coleford, Gloucestershire, Ironmaster; for an improvement or improvements in the process or processes of making or manufacturing iron. Dated July 27, 1815.

JOHN LEWIS, of Brinscomb, Gloucestershire, Clothier; for an improved shearing machine. Dated July 27, 1815.

JOSEPH HARVEY, of Long-lane, Bermondsey, Surrey, Turner; for a machine for better striking and finishing of leather. Dated August 4, 1815.

WILLIAM EDRIDGE, of Rotherhithe, Surrey, Brass-founder; for an engine, pump, or fire-engine. Dated August 4, 1815.

JOHN STREET, of Clifton, Gloucestershire, Esquire; for certain further improvements in the mode of making and working bellows. Dated August 11, 1815.

RICHARD DIXON, of High Holborn, Middlesex, Trunk-maker; for an improvement or improvements in the construction of trunks or portmanteaus of various descriptions,

heated or chemically-changed air, gas, smoke, vapour, elastic matter, or flame, to escape from the burning fuel. And, farther, I make and affix in or unto each of the said last-mentioned apertures or aperture, a cock, slide, shutter, valve, or other similar piece or pieces of mechanism, by means of which I can open or shut the same at pleasure. And, farther, I affix unto the said aperture, or each of the said apertures, if more than one, a chimney, tube, or chamber, directed upwards, downwards, or obliquely, and of a cylindrical figure or otherwise (but being air-tight): and I make the dimensions of the said chimney, tube, or chamber, or chimnies, tubes, or chambers, such, that the internal capacity thereof shall be wholly, or nearly, occupied by the heated or chemically changed air, gas, smoke, vapour, elastic matter, or flame, from the burning fuel, or other ignited material, whensoever the communication or communications through the aperture or apertures thereunto belonging shall be opened by the last-mentioned cock, slide, shutter, or valve, or cocks, slides, shutters, or valves. And I construct at the said upper part or termination of the said air-tight chimney or chimnies, tube or tubes, chamber or chambers, one or more cock or cocks, slide or slides, shutter or shutters, valve or valves, or other similar piece or pieces of mechanism, by means of which I can open or shut the same at pleasure. And I farther declare, that the operation and effect of my said machine is produced and takes place from the action of the ignited fuel or fire, of whatsoever kind, upon the air, gas, vapour, or other elastic matter, which is contained in the said chimney, tube, or chamber, or chimnies, tubes, or chambers, and which may be alternately confined and retained by means of the aforesaid cock or cocks, slide or slides, shutter or shutters, valve or valves, or other similar piece or

pieces

THE
REPERTORY
OF
ARTS, MANUFACTURES,
AND
AGRICULTURE.

No. CLXII. SECOND SERIES. Nov. 1815.

Specification of the Patent granted to James Collier, *of Grosvenor-street West, Pimlico, in the County of Middlesex; for an Apparatus, Machine, or Instrument, intended to be denominated a* Criopyrite, *by means of which, Power will be very economically obtained, and advantageously applied, to the raising of Water, and other useful Purposes.* Dated January 16, 1815.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said James Collier do hereby declare that the nature of the said invention, and the manner in which the same is to be applied and performed, is particularly ascertained and described as follows; that is to say: I construct a furnace or furnaces, grate or grates, for containing fuel in combustion, and closed, or capable of being closed, so as to be air-tight on all sides, but provided with a flue or flues, and communication or communications, for admitting atmospheric air, for the purpose of keeping up combustion, together with dampers, regulators, or other useful and well-known fittings, if preferred; and also provided with a fit aperture or apertures, for allowing the

possible, that space which was lately dilated and expanded now becomes cooled, contracted, and condensed, and leaves the internal capacity or space comprehended within the said chimney, tube, or chamber, or chimnies, tubes, or chambers, in a state approximating towards a vacuum, more or less perfect; and thus by the alternate opening and shutting of the cocks, valves, slides, or shutters, situated as hereinbefore described to a fixed fire, furnace, grate, or ignited materials, or by alternately introducing and withdrawing a moveable fire, with its furnace, grate, or receptacle, for ignited materials, into a chamber, tube, or chimney, or chambers, tubes, or chimnies, fitted up with proper and sufficient cocks, valves, slides, or shutters, to confine the expanded air, gas, smoke, vapour, or other elastic matter, within the said tube, chimney, or chamber, or tubes, chimnies, or chambers, or to prevent the external air from getting into the aforesaid vacuum or vacuous space, or any of them, when produced, an alternate force or power will be generated, acting first by the pressure of the dilated or expanded air, gas, vapour, flame, or other elastic fluid, upon whatever machinery may be connected therewith, and then by the vacuum or vacuous space; both of which forces or powers may be applied to the immediate raising of water in tubes, or by any other means, to the working of various pumps, or to the motion of a piston or pistons, well fitted in a bored or smooth cylinder or cylinders, in the usual way in which pistons are applied within cylinders, with proper stuffing boxes, packing, or otherwise; or the furnace, grate, and fire, or ignited materials, may be moved immediately from the inside of one chamber, tube, or chimney, to the inside of one or more other chambers, tubes, or chimnies, fitted up and provided with proper cocks, slides, valves, or shutters,

situated

situated as hereinbefore described; by which means the expansive force will take place in one chamber, tube, or chimney, while the condensation or vacuous space is forming in another chamber, tube, or chimney, and by connecting the said chambers, tubes, or chimnies, by proper air-tight tubes, to the opposite sides or surfaces of the aforesaid piston or pistons, or other work or resistance to be overcome, great advantages may be derived. But as the machine will act by the expansive force of the heated or otherwise chemically changed air, gas, vapour, smoke, flame, or elastic matter alone, or by the vacuum or vacuous space to be obtained as aforesaid, or by both conjointly, I do declare that it may be employed in either or all these manners, as may best suit the particular case or cases immediately, as a first mover, to give motion to machinery, and to produce all the useful effects which can result from the employment of steam, or any other elastic and expansible fluid, body, or thing.

And I do farther declare, that the apparatus, machine, or instrument, consisting of the several parts hereinbefore described, is the apparatus, machine, or instrument, which I denominate a *Criopyrite*; by means of which power will be economically obtained from the expansive force and subsequent vacuum or vacuous space produced thereby, and may be advantageously applied to the raising of water, and to the other useful and well-known purposes heretofore effected by means of an expansive power and a vacuum, howsoever otherwise obtained.

And I do farther declare, that although the *Criopyrite* will produce its effect by the alternate opening and shutting of the communications aforesaid through one chimney, tube, or chamber; yet the alternate or conjunctive use and operation of two or more chimnies, tubes, or chambers,

chambers, may be advantageously employed, so that the heated or chemically changed air, gas, smoke, flame, vapour, or elastic matter, may constantly pass from the furnace or furnaces, fire-place or fire-places, or receptacle for fuel, or other burning materials, and produce a greater and more continuous effect.

And, farther, that whensoever, during the activity of the operation of the said apparatus, machine, or instrument, the said cocks, slides, shutters, valves, or other similar pieces of mechanism belonging to any chimney, tube, or chamber, or chimnies, tubes, or chambers, are opened, the atmospheric air rushes in, and destroys and counteracts the effect of the vacuum (as intended) within the said space; and that immediately upon shutting one of the said chimnies, tubes, or chambers, the other or others is to be opened; and that the effect of the vacuum or vacuous space in each of the said chimnies, tubes, or chambers, may be made to take place either separately or in conjunction.

And, moreover, I declare, that I do claim and reserve to myself the right of applying fire or heat to the *Criopyrite* in any form or direction that may be suited to the situation and circumstances under which the machine may be erected, and so as to avail myself of the ordinary action and effect of combustion, or of the reversed flame, or any other operation by which fire, flame, or heat, can be applied for the purpose of expanding or dilating any air, gas, vapour, or elastic matter, or of obtaining a vacuum or vacuous space, whether that fire or heat be produced, made, and maintained, in a stationary furnace, grate, or other receptacle for ignited materials, and admitted into the chimney, tube, or chamber, or chimnies, tubes, or chambers, by the alternate opening and shutting of any cocks, slides, shutters, or valves, as before described;

described; or whether the fuel, fire, or ignited materials, shall be contained in a moveable furnace or grate, fire-place, or receptacle for ignited materials, to be alternately moved into, or brought out of, the said chimney, tube, or chamber, or chimnies, tubes, or chambers, by any of the common and well-known processes for moving machinery; or whether the said chimney, tube, or chamber, or one or more of them, shall be moveable and brought to a fixed fire or heat, or whether the said chimney, tube, or chamber, or one or more of them, shall in the first instance be filled with carbonated hydrogen gas, or any other inflammable air or gas which may be made, generated, or produced from the fuel, fire, or ignited materials, or from such other ingredients as may be capable, and will produce inflammable air or gas, either by exposure to a fire or otherwise, and which inflammable air, gas, flame, or smoke, when so produced and admitted into the said chimney, tube, or chamber, or chimnies, tubes, or chambers, may afterwards be ignited or inflamed so as to produce a vacuum or vacuous space. In all which constructions I avail myself of such good and sufficient cocks, slides, shutters, or valves, as are commonly used, and may be most efficient for preventing the passage of any air, gas, steam, water, or other fluid, and consider it unnecessary to describe the exact form, positions, or places, of such cocks, slides, shutters, or valves, as they must in a great measure depend upon the local and particular situation of the machinery; and their situations must be evident to all persons acquainted with machinery, actuated by an alternate vacuum or vacuous space or spaces, and the pressure or elasticity of any air, gas, steam, water, or other fluid. And I do also avail myself of immersing the chimney, tube, or chamber, or chimnies, tubes, or chambers, and the cocks, slides, shutters,

ters, or valves, leading thereto, as before described, in water, or any other cooling agent, in case a more rapid cooling, contraction, and condensation, may be required than would be produced without such means, by the ordinary process of cooling and condensing in the open air, or otherwise.

And that, lastly, with regard to the instruments or machines which produce their effects by means of an expansive force and vacuum or vacuous space, such as the very numerous class of pumps, and the steam-engines of Worcester, Savary, Newcomen, Watt, and others, with the extensive and multiplied uses and applications of them in modern times, I consider that it would be scarcely possible to enumerate and describe the same, and unnecessary, because the same are in the hands of the public, and well known as to the means of connection of the same with pipes, pistons, valves, and other needful apparatus, to all practical men accustomed to works of this or the like nature; but that, whatever may be the kind of machinery to be connected with a *Criopyrite*, I do employ the motion of the said machinery to perform the office of moving the furnace or furnaces, grate or grates, or other receptacle or receptacles, for containing fuel, fire, or any ignited material or materials, when the same may require to be moved, and of openning and shutting the needful cocks, valves, slides, shutters, and communications, at the fit and appropriate instants of time as before described and required to be done. And that, for the said last mentioned purpose, I do make use of such gear as is or hath been commonly used to open and shut the valves or parts of communication in steam-engines and other machines.

In witness whereof, &c.

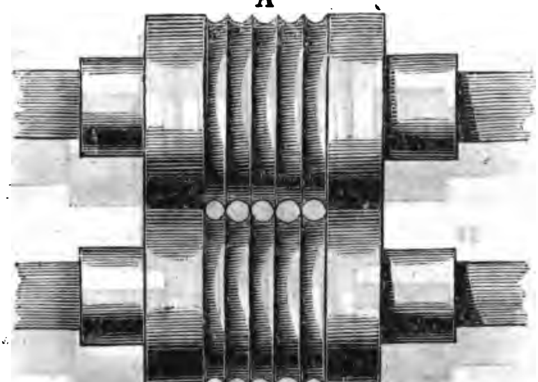
Specification

Specification of the Patent granted to WILLIAM BELL, *of Birmingham, in the County of Warwick, Engineer; for a new and improved Method of making and manufacturing Wire of every Description.*

Dated April 18, 1815.

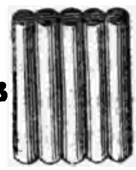
TO all to whom these presents shall come, &c. NOW KNOW YE, that in in compliance with the said proviso, I the said William Bell do hereby declare that my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and the following description thereof; that is to say: I make use of rollers, made of iron, steel, or other metals, such as are applied to flatting or rolling of metals; and in order to obtain the impressions for rolling the different sorts of wire, I indent my rollers by turning in them fluted hollows, reeds, or any other required form, as appears in drawings annexed, at letter A. Or otherwise I produce

A

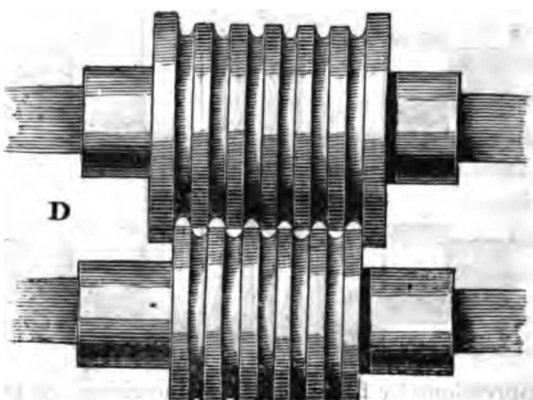


the impressions by filing, cutting, punching, or by casting my rolls with the impressed form upon them, from

patterns or moulds made for that purpose. My rollers being thus prepared, are put together in a frame, and placed parallel to each other, in the usual way, as they are done for rolling or flatting. I then pass such rolled or flatted metal, as occasion requires, between the said rollers, as before described; and by compression I produce the figure, form, and size, intended, as at B. The

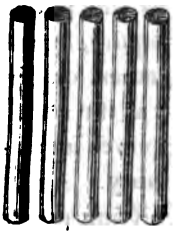
B 

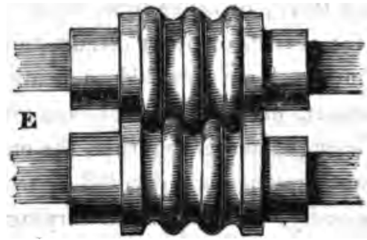
next part of my process is in dividing or separating the wires from each other, which I perform by the use of slitters, nearly similar to such as are used for slitting sheet iron into rods, or I can separate them by circular or lever sheers, or by tools worked in a fly press, or by rollers inverted, as appears at D.

D 

Letter

Letter C represents the wire divided. There are various ways by which the wires may be separated; as, for instance, letter E represents a pair of rollers, formed for

C 



the purpose of passing the rolled wire metal through, by which the wires become divided, by breaking them one from the other. In witness whereof, &c.

Specification of the Patent granted to JEAN RONDONI, *of Oxford-street,, in the County of Middlesex, Gentleman; for certain Improvements in the Construction of Dioptric Telescopes. Communicated to him by a certain Foreigner residing abroad.* Dated January 20, 1815.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Jean Rondoni do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, are particularly described and ascertained in manner following; that is to say: It doth consist in the varying the magnifying power of dioptric telescopes, by my improvements in the same, for the well known benefit and advantage thereby derived, and the manner of performing the same is set forth hereinafter, and by the drawings hereunto annexed. And, firstly, with regard to varying the magnifying power of telescopes, when the eye-glasses of the same are to be con-

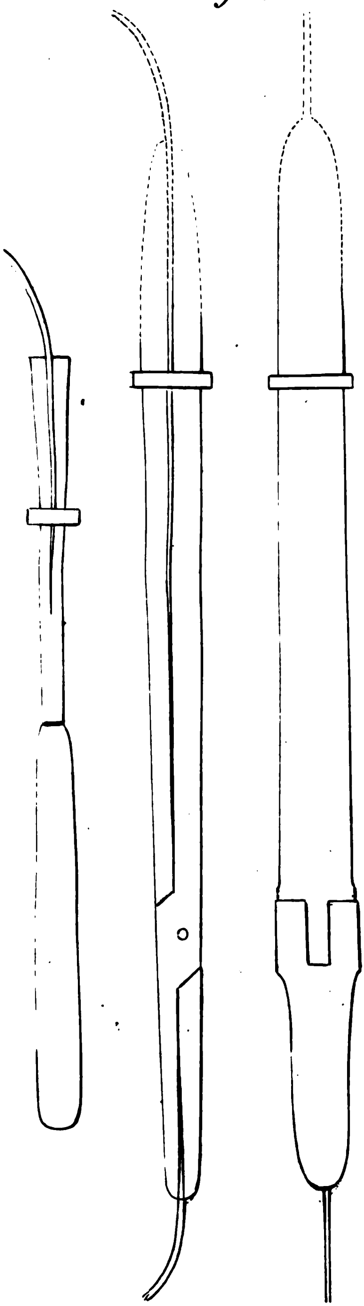
cave, or bear a diminishing power, I do form the eye part of two concave glasses, placing one in the side or tube nearest the eye, and the other in the next, or second, or third, or other tube, from the eye, as the power of the glasses or other circumstances may require, by which means I am enabled to bring near together, or divide apart, my said two concave glasses; and as the same are brought nearer together, the magnifying power increases, and as they are divided apart, the contrary. And, secondly, with regard to varying the magnifying power of telescopes of the usual construction, with four convex glasses in the eye part, I do construct them in such manner that the third and fourth glasses from the eye may be moved farther from, or nearer to, the eye, by the means and after the manner following.

Fig. 1, (Plate X.) in the said drawings, represents a longitudinal section of the eye part of a telescope, having four convex glasses in the same, and supposed to be placed at the usual relative distances from each other, having regard to their several powers. $a\,a^1$, $a\,a^2$, represents the external tube of the said eye part, having therein the two slits or openings $c\,c^1$, $c\,c^2$, one of which openings is again represented at $c\,c^2$.

Fig. 2, *b b*, *b b*, is a tube, containing the first eye-glasses, Nos. 1 and 2, and the stop *d*, similar in all respects to tubes in the like situation in common use, and therefore forming no part of the improvements. 5, 6, 5, 6, is a tube, carrying on it the glass 3; and 8, 8, is a welt or protuberance formed thereon, so as to touch and press on the internal surface of the tube $a\,a^1$, $a\,a^2$. 7, 7, is another protuberance on the internal surface of the tube $a\,a^1$, $a\,a^2$, touching and pressing on the external surface of the tube 5, 6, 5, 6. 9, 9, is another protuberance in the internal surface of the tube 5, 6, 5, 6, and at 6, 6, in

Pl. X. Vol. XXVII Second Series.

Fig. 3.



Mr. Bottomley's Surgical Instrument.

Fig. 1.

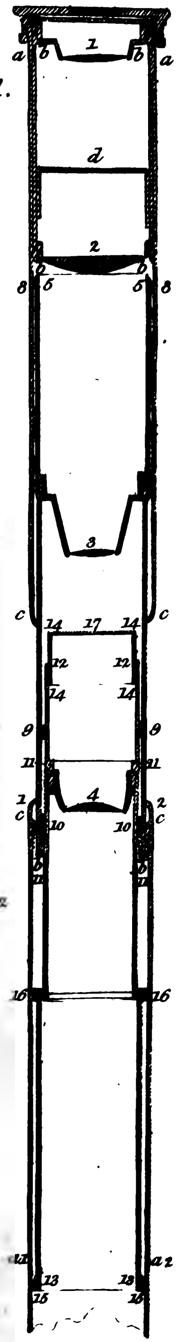
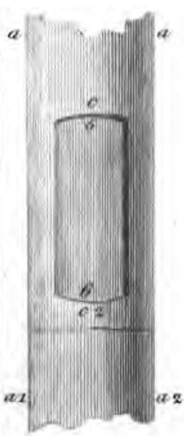


Fig. 2.



Mr. Rondoni's Telescope.

in a ring screwed into the same tube, and forming another protuberance internally and externally 12, 13. 12, 13, is a tube, part of which passes freely within the tube 5, 6, 5, 6, and carries within it the glass 4, and 14, 14. 14, 14, is a stop, perforated at 17, and supposed to lie at the proper situation usual for a stop, between the glasses 3 and 4, and in the external surface of the tube 12, 13. 12, 13, at 11, 11, is a thread or screw cut on the same, and 10, 10, is a stop, capable of being screwed backward and forwards thereon, and allow the tube 12, 13, 12, 13, to pass farther into the tube 5, 6, 5, 6, on the contrary, and regulate or adjust the proper distance between the glasses 3 and 4 whilst in the usual situation. 15, 15, and 16, 16, are two bearing pieces pressing against the tube $a\,a^1$, $a\,a^2$, and causing the tube 12, 13, 12, 13, to pass steadily up and down the same.

And I do, (supposing the glasses 1, 2, 3, 4, to be at their proper relative distances, with regard to the power thereof, or other requisites, according to the usual formation of telescopes,) by pressing on the tube 5, 6, 5, 6, at the aperture $c\,c^1$, $c\,c^2$, force the same forward, and cause the glass 3 to come nearer to the glass 4, and farther from the glasses 1 and 2, and thereby gradually increase the magnifying power of the telescope; and when thereby the stop 9, 9, has come in contact with 10, 10, the tube 12, 13, 12, 13, and the glass 4, in the same, are passed forwards in the same direction, and with the glass 3, by which the magnifying power of the said telescope is still increased; and as either of the said movements and increase of magnifying power takes place, the whole eye part of the telescope must be drawn out with the tube $a\,a$, $a\,a^2$, to increase the distance from the object-glass, and in returning the same to or towards their original situation the contrary. And in adapting my said

improvement,

improvement, relative to telescopes with convex eye-glasses, where the number of tubes or slides is increased for the sake of portability or compactness, I do form the part of tube 12, 13, 12, 13, between the bearing parts 16, 16, and 15, 15, much shorter, and fit to the internal diameter of the second tube from the eye, and to form the rest of my before-described alterations in the first tube next the eye.

And, moreover, my said improvements may be varied and adapted, with regard to dimensions and formation; and that the moveability of the glasses may be done by means of wheel and rack work, or screw and nut, or other well-known means not required here to be particularised, and which any competent workman, in works of this and the like nature, can devise and execute.

In witness whereof, &c.

Specification of the Patent granted to JOHN PUGH, *of Over, in the Parish of Whitegate, in the County of Chester, Salt Proprietor; for making and altering Salt Pans on an improved Principle.* Dated May 26, 1815.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Pugh do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described as follows; that is to say: The rims of the salt pans are to be made in the usual manner. Those parts of the pan bottoms which are immediately above or over the centre of the fires are to be lowered and sunk about a foot, more or less, from the front rim, in an oval, circular, oblong, square, or any other form, as I think proper to be so lowered; that the lowest part be twelve inches, more or less, according to the size of the pans, deeper than the general level of the bottoms of the pans, and the bottom of

of the lowered part to be either flat or rounded. The whole of the before-mentioned sunk or lowered parts are to be made of cast iron, wrought iron, copper, or any other metal, as I think proper; or the sides may be made of one kind of metal and the bottoms of another kind. If cast iron or copper be used, the sides and bottoms should in that case be cast separately: the upper and lower part of the sides to have flanges of about six inches broad, more or less, with holes, either cast or drilled, to admit screws or rivets, by which they are to be joined or fastened to the adjacent level parts of the pans. When the oblong square form, with rounded bottoms, is adopted, (which is the best form,) for a pan of one thousand feet measurement, with four fires, the following dimensions of the lowered or sunk parts, as before described, will be sufficient length or conjugate diameter, five feet breadth, or transverse diameter, two feet and a half, depth of the centre one foot, and so in proportion for a pan or pans of greater or lesser size, and also in proportion to the number of fires used under them, and according to the kind of salt to be manufactured, the fore part of the pan or pans should have lids or covers, made of wood, or other light materials, more or less in number, according to the width of the pan, which are to cover the surface of the brine, from one side of the pan to the other, as far as the before-mentioned sunk or lowered parts extend. These lids or covers should be hung by hinges, on a strong rod of iron, reaching entirely across the fore part of the pan, and resting on the side rims, the front part of the lids or covers resting upon the front rim; which lids or covers should be made to draw up and down by means of ropes and pullies, fastened to the timbers in the pan house roof, or they may be suspended by means of ropes and pullies fastened to the roof of the

pan

pan house, so that they may be raised up or let down upon the rims of the pans and the transverse iron rod, before mentioned. A drop board, of thin wood or other light materials, should also be affixed to the back part of the lids or covers with hinges, or otherwise, so as to admit of it being moved up or down, according as it is found necessary, to confine the heat in the brine over the fires, and to accelerate the boiling. Pans made on this principle and construction will allow of the fire grates being made considerably shorter and narrower than those in ordinary use; and by the parts of the pans over the fires being sunk lower than the rest of the pan bottom, a sufficient quantity of brine will be contained when little or none is left to cover the other parts. Thus a much greater and more permanent degree of heat can be applied with considerably less fuel, and without the risk of burning the pan bottoms, an occurrence very frequent in the common way of making pans; of course there will be a very considerable saving of expense in the articles of coals, iron, and labour, as less coals, less iron, and repairs, will be wanted by the adoption of my invention. The advantages arising from the lids or covers are as follows: by preventing evaporation over the fires, a much greater or more intense degree of heat is caused to accumulate in the subjacent brine, which, producing a current, propels the salt forward into the pan, and prevents the deposition of it over the fires, which would soon prove destructive to the pan bottom. The heat also, by being confined and becoming more intense, will consequently be more rapidly and more equally diffused throughout the whole contents of the pan, by which means great quantities of salt, and of a superior crystallisation and quality, will be made than in pans of the ordinary construction. In witness whereof, &c.

Additional

Additional Remarks on Mr. BAGOT's *Patent, inserted in the "Repertory" of last Month, for passing Vessels from one Level to another on Canals.*

Communicated in a Letter to the Editors, by the Patentee.

GENTLEMEN, *Birmingham, Oct.* 10, 1815.

AT the time I forwarded to you a duplicate of the specification of my Patent for passing boats, &c. from different levels of canals without loss of water, with some observations on the advantages to be derived therefrom, which were inserted in the "Repertory of Arts" of last month, it did not then occur to me that it was necessary to say more on the subject, but as it appears that many very erroneous conjectures have been formed relative to the time it will require to fill a lock with water, by the improved system therein described, I am induced to forward the accompanying paper, containing calculations of the time in which a lock may be filled by the proposed improvement, which may be considered as additional to the observations before transmitted, and which I trust will enable the readers of your valuable work fully to appreciate the advantages to be derived by the improvement therein proposed for adoption.

It may be deemed by many an essential thing to shew that the advantages before pointed out, in the observations accompanying the specification of my patent, inserted in the "Repertory" of last month, may be attained in such a reasonable time as will enable companies adopting the proposed improvement to pass a trade on their canals; for it may be urged, that allowing a lock on this principle could be filled in an hour, or even a quarter of an hour, yet the benefits to inland navigation would be so limited that in most cases it could not be applied with any advantage whatever, as it would not in

 this

this case be capable of passing a trade: But if it can be shewn, in a clear and rational manner, that all the advantages therein enumerated conjoined can be attained in such a short space of time as to pass an equal, or even a greater, trade on canals than is at present done by locks on the best constructed principles, such a statement would, I should conceive, induce proprietors of canals, and others interested therein, to avail themselves of the benefits to be derived therefrom, by adopting the proposed improvement without any hesitation.

I will therefore suppose, that in applying the principle of raising water from the lower levels of canals into the upper, according to the improvement laid down in the foregoing specification, inserted in the "Repertory" of last month, page 262, it should be proposed to apply the same to a six feet lock, which I will suppose will require one hundred tons of water to fill, and that the evacator should have a cubical capacity, equal to ten tons of water, which it may be deemed necessary to throw into the lock at each depression of the evacator in the forcing chamber, and that the evacator shall be depressed two feet at each operation to perform the same.

The cubical content of ten tons of water is 358.4 feet, which, divide by two, the depth the evacator is to sink in the forcing chamber will be equal to 179.2, whose square root, 13.38656, will be equal to the side of the evacator, which will displace ten tons of water on being depressed two feet in the forcing chamber. I will take the side of the evacator at 13.4 feet, and suppose it is thought necessary to employ the power of four men, each of whose exertions shall be equal to one hundred weight. Divide the whole weight of the water to be displaced, which is equal to ten tons, by 4, the number of men to be employed, the quotient will be two tons and a half for each

each man's power to overcome, which I will assume as the power of the depressor.

As the increments of weight are proportional to the depths, the evacator is to be depressed in the forcing chamber, and will increase from 0 to ten tons; it will require a power of 2½ tons to sink the evacator six inches in the forcing chamber, five tons will sink it one foot, and at two feet it will require the whole force of ten tons.

Therefore, taking a depressor, the diameters of whose pistons are as two to one, and supposing the lever thereof to have a power of ten to one, and that the weight of the lever shall be equal to 28lbs. a power of 112lbs. applied to the end of such lever will be able to sink the evacator six inches in the forcing chamber, and thereby displace 2½ tons of water, which will be driven into the lock; second power, of 112lbs. will sink the evacator a farther depth of six inches; and a third and fourth power, each of 112lbs. being applied, will cause the whole quantity of ten tons of water to be driven into the lock. And supposing the length of each stroke of the injector to be six inches, and the diameters of the pistons of the depressor and injector, as before stated, to be as two to one, at four strokes of the injector, the piston of the depressor and the evacator will have sunk six inches in the forcing chamber, so that at sixteen strokes of the depressor ten tons of water will be forced into the lock. And supposing the lock, as first stated, to hold 100 tons of water, at 160 strokes of the lever of the depressor, the lock will be filled. And allowing that forty strokes *per* minute may be made by the men, in four minutes with a single injector, 100 tons of water are shewn to be capable of being forced into the lock with a power of 4 cwt. added to the weight of the lever; and if two injectors are used, which I should at all times recommend, the time

will be reduced to one-half, or two minutes; and, in fact, it may be performed in any given time, as it is only necessary so to apportion the power to the time that there may not be any waste thereof, and the effect is gained.

It may be urged, that in this calculation there is not any time allowed for the forcing chamber being refilled from the lower level of the canal. This is granted. But, in answer, it is only necessary to remark, that this will not be requisite. For if a second forcing chamber be attached, extending likewise alongside of the lock, and the same injectors be made to communicate with the piston of the depressor, merely by opening a connecting valve, the effect is gained; for one forcing chamber will be filling whilst the other is emptying, and so on until the lock is filled. Or, after the lock is filled, and the upper pond of the canal should require to be furnished with water, until that end is fully accomplished.

In this statement it will be perceived there is not any notice taken of the water which must be displaced in the lock by the boat and cargo, which will fluctuate between ten and thirty tons, according to circumstances, whether the boat be empty or loaded; and which, had I taken into calculation, would have lessened the time here deduced considerably. But I thought it best to shew the time in which a lock can be filled by this improved system, leaving the water displaced by the boat and cargo totally out of the question.

Thus I have shewn, in the most clear and unequivocal manner, that the advantages before pointed out are all gained by a simple, efficient, and rational process, and by means which can easily be applied to locks on the present construction, so as to enable them to pass a trade, and save all the lockage water they before lost.

Yours, &c. THOMAS BAGOT.

Description

Description of an Instrument for performing Surgical Operations. By Mr. John Bottomley.

Communicated in a Letter to the Editors.

With an Engraving.

Gentlemen, *Scarborough, Sept.* 28, 1815.

I LATELY shewed the surgical instrument, described in No. 159 of your Repertory, page 138, to an eminent surgeon, who very highly approved it, but told me, that in some operations the projecting of the head of the screw would be attended with inconvenience: to avoid which, I proposed to him the use, in such cases, of an instrument formed on the plan of the sliding tongs used by watch-makers. He has since had an instrument constructed on the plan of the pin-tongs, and has used it in a case of polypus in the throat with great facility and success.

Annexed are sketches of both instruments. (See Fig. 3, Plate X.) That on the plan of the sliding tongs I should think the better of the two, especially for those extraordinary operations for which they are intended, for it grasps the needle more firmly than the other, and however deep the cavity into which it may be introduced, the slider, being situated at the outer end, can always be conveniently reached. Besides, by reversing it, as is shewn in the dotted lines of the sketches, the other instrument is in effect produced.

Hoping you may not consider me enlarging too much on these little matters, but may be pleased to accept this communication, and give it with all convenient speed to the public, I remain,

Yours, &c.

John Bottomley.

Remarks

Remarks on the Employment of Oblique Riders, and on other Alterations in the Construction of Ships. Being the Substance of a Report presented to the Board of Admiralty, with additional Demonstrations and Illustrations.

By THOMAS YOUNG, *M. D. For. Sec. R. S.*

(Concluded from Page 293.)

Grounds of Decision respecting Oblique Riders.

THIS comparison therefore brings the question, respecting the general utility of oblique riders, into a very narrow compass; and we have only to inquire in what way it is most usual for ships to exhibit symptoms of weakness, in order to decide it. Now it will appear that, in cases of arching in general, some of the butts of the planks are always found to have parted aloft, at the same time that the angular position of some parts of the structure has as uniformly been more or less altered; and very generally a certain degree of sliding is observable in the planks at the sides of some of the ports. This sliding is seen very distinctly in the planks of the Albion and of the Belliqueux, now at Chatham: at the same time there are also obvious indications of a certain degree of extension and compression; in the Albion, the butts of the planks have parted so far, that in some instances pieces have been let in between them: and in the Belliqueux there is a space of about five inches between the middle of the deck transom and the carling, which had originally been in contact with it. In the Asia, lately launched in the Medway, the arching amounted to three inches and a quarter, and the comparative length of the upper and lower parts was probably altered about two inches at most: the parting of the butts amounting to three-sixteenths of an inch each "for upwards of fifty feet

feet in length in the midships, and for about eight feet from the top of the side;" making a total extension of probably less than an inch : so that about half the effect seems to have been produced in one way, and half in the other; but apparently the greater half by the want of stiffness. It is also usually observable, that there has been some degree of permanent compression or crippling below, the butts of the planks opening when the cause of arching has been removed, and the sheathing being more wrinkled than would have happened from the simple bending of the planks. Where it has been observed that the fore part of all the treenails supported the pressure of the planks in the after part of the ship, and the after part in the fore part of the ship, the observation must probably have been made on the lower parts of the ship, from the effect of a partial compression of this kind.

Authorities.

From this statement it appears, that unless some very strong facts can be produced, to disprove the probability that the relative angular position of the parts constituting a ship may always be materially altered, without an absolute failure of strength, it cannot be denied that the principle of oblique bracing offers a remedy for the tendency to arch, whatever doubts there may be of the efficacy of any particular mode of applying it. And even if no observations could be produced in confirmation of the frequent occurrence of such a change of the angular situation of the timbers, the supposition that the stiffness could be perfect in this respect, notwithstanding the unequal shrinking of the timbers, and other similar circumstances, while the ultimate strength gave way by the failure of the fastenings, is in itself so highly improbable, that no positive evidence would be required for

for its complete rejection. We shall find accordingly, that Mr. Bouguer takes for granted the existence of a partial flexure, as sufficiently admissible without direct proof, and recommends the adoption of oblique planking as a remedy; and that other experienced authors have been equally favourable to the employment of some similar arrangements. In speaking of Mr. Gobert's mode of placing the cieling of a ship obliquely, Mr. Bouguer observes, that "this method cannot fail of producing the most desirable effects; for when the planking both within and without was arranged in the direction of the keel, it happened, in case of the ship's arching, that the rectangles formed by the timbers and the planking, merely changed their figure a little, so as to become rhomboids, two of the angles opening a little, while the other two became more acute: but when the planks of the cieling are laid in an oblique direction, they serve as *diagonals* to the rectangles, so that a simple change of the relative angular situations of the sides is not sufficient to admit of the arching, without an alteration of the length of the diagonals, which would afford a resistance incomparably greater, especially at the upright parts of the sides, although at the floors it would have but little effect." Traité du Navire, 154. Mr. Groignard also, whose memoir, on the improvement of ship-building, has been obligingly communicated to me by an ingenious gentleman, formerly his pupil, although he objects to Mr. Gobert's method, confesses that he "should have very much approved this mode of disposing the cieling, if it had been possible to employ straight planks having the same obliquity, without interruption throughout the whole of the ship's length;" but thinks, with Bouguer, that in carpentry "every interruption is to be avoided as dangerous;" an objection so vague, as neither to require

nor

nor to admit a very distinct reply. Don George Juan too, after a calculation of the absolute strength of the pieces of timber employed in the construction of a ship, very properly remarks, that the effect of arching must be attributed not to their want of strength, but to "their play on each other."

9. *Mr. Seppings's Braces.*

It appears therefore to be sufficiently established, that the principle of employing oblique timbers is a good one, provided that it be so applied as to produce no practical inconvenience. We must next inquire, whether Mr. Seppings has introduced it in a manner likely to be effectual, and not liable to any material objections. He places, on the sides of a 74 gun ship, several series of oblique braces, principally between the ports, in the place of the internal planking, making an angle of about 24° with the decks; consisting of planks four inches thick and about eleven wide, coaked and bolted to the timbers, and abutting against upright pieces similarly fastened. Now it follows, from what has already been stated, that these pieces have about four-fifths as much effect in co-operating with the neighbouring parts, which act horizontally, as if they had been placed in the same situation with them, even on the supposition that the relative angular situation of the pieces is unalterably fixed: but for preventing the alteration of this situation, there is no doubt of their being very advantageously arranged, so far as their strength is sufficient; and the existence of a tendency to such an alteration, in a very material degree, appears to be altogether indisputable. Below the gun deck, the oblique timbers are considerably stronger, although they act under circumstances somewhat less favourable.

 If,

If, however, the resistance of a part of a structure is very immediately directed against a certain force, without an adequate co-operation from other parts of that structure, and if, being abandoned by those parts, it is exposed to a strain which it is too weak to withstand, it is obvious that it must inevitably be the first to give way, and must leave the rest of the fabric more exposed to be overpowered by such a force, than before its introduction. We must therefore inquire, how far it is possible that Mr. Seppings's braces should be so abandoned. Now supposing a 74 gun ship to arch two feet, and one half of the change to depend on the sliding of the planks over each other, which will be allowed, by those who doubt the utility of the arrangement, to be fully as much as can ever happen; the greatest fall of the surface will be one foot in forty-four, and the length of the brace will be diminished $\frac{1}{118}$, or $\frac{7}{10}$ of an inch in the length of *six feet*, which, with a moderate allowance for the partial yielding of the fastenings, it will be perfectly capable of supporting without being crippled, although indeed it could scarcely support much more. It is obvious, however, that this supposition in many respects far exceeds the utmost that can possibly happen: and it would even require a greater force to produce such an effect on the braces, than any which the ship actually sustains. In order to calculate the magnitude of the greatest strain which these pieces could support, it will be safest to proceed on the supposition, that each square inch of the section of good oak timber is capable of resisting the pressure of four tons on an average: it will then appear that a single series of such braces, as Mr. Seppings employs, extending throughout the length of each side of the ship, would support a weight of 143 tons, in whatever way the force counteracting it might be applied;

and

and estimating the effect of all the braces and riders as equivalent to about four such series, the whole would resist a force of 570 tons; while the greatest force derived from the distribution of the weight, together with the action of such waves as we have considered, amounts to about 450 tons: so that the strength of these braces can scarcely be insufficient to support the pressure, unless the ship should be left dry, resting on the middle of her keel, and the braces should be abandoned by all the other parts, which usually co-operate with them *. The fastenings must indeed be considerably weaker than this, and the other parts of the ship considerably stronger; but since the fastenings appear to possess sufficient strength to resist any strain which is actually likely to affect them, there seems to be no inconvenience in their inferiority to the other parts. In fact, the Tremendous actually supported for three days, without any perceptible change of form, a strain fully equal to that which is

* If a jointed parallelogram, composed of pieces of invariable length, having one of its sides fixed in a vertical position, be supported by diagonal brace, the compression or extension of the brace will be to the descent of a weight connected with the moveable end of the parallelogram, as the depth of the parallelogram to the length of the brace, whatever the actual distance of the weight may be; so that although the strain on the horizontal pieces increases with this distance, that which affects the brace is independent of it; the relative being to the absolute strength as the depth of the frame is to the length of the brace. We must therefore inquire, what is the greatest absolute force that can be supposed to urge a given portion of the fabric in either direction: thus the excess of weight which has been attributed to the bowsprit and the neighbouring parts being 192 tons at 19½ feet from the head, this force may be occasionally increased by a similar pressure derived from the effect of the waves, which alone would amount to 302 tons at 35½ feet from the head, and which may sometimes co-operate with the former, so as to constitute a force of about 450 tons, about 25 feet from the head.

 here

here calculated, having been purposely left on shores, which extended through fifty-two feet only of her length. But it must be remembered, that such a force, from its very gradual application, must be much less trying to the ship's strength, than the more abrupt changes which occur at sea, and it must on the whole be inferred, that it would be unsafe to trust to the braces alone, unsupported by the co-operation of the neighbouring parts. It would probably be easy to add some further strength to these braces near the ends of the ship, where the strain on them is the greatest, especially about thirty feet from the head, if it were found that they gave way before the rest of the timbers; and it might also be possible to replace them, if they had once failed, with greater ease than many other parts of the fabric.

It may be questioned how far it is allowable to omit any part of the inner planks between the ports, for which the braces are a substitute, on account of their utility in securing the butts of the planks, which are always made to shift where they are supported by this subsidiary tie: but with the outer planking which remains, and with the partial assistance of the braces, to say nothing of that of the shelf pieces, it can hardly be believed, that the tie is more likely to part between two ports of the same deck, than immediately over one of them.

It has been very ingeniously observed, that arching is not only a part of the evil occasioned by a ship's weakness, but that it has an immediate tendency to afford a partial remedy for the cause which produces it, by making the displacement greater at the extremities of the vessel, and smaller in the middle: but, in fact, this change appears to be too inconsiderable in its extent, to produce any material benefit: the strain at the midships being diminished by each inch of arching only sixty-six tons,

tons, supposed to act at one foot: so that very little relief is obtained from the change, in comparison with the whole strain.

The case of the Kent, which broke in a remarkable degree, notwithstanding the employment of riders of large dimensions, is perfectly reconcileable with the principles which have been laid down: indeed these riders, which made an angle of a few degrees only with a vertical line, could have so little effect either on the strength or on the stiffness of the structure, that there was not the slightest reason to expect any material advantage from their application.

The explanation which has been given of the universal tendency of ships of war, in all common circumstances, to arch throughout their length, is sufficient to justify the different directions in which Mr. Seppings now arranges his braces in the different parts of the ship, since they must necessarily afford a greater strength as shores than as ties, and since the most permanent and the greatest strain will generally be such as to call them into action in this capacity. When, however, a ship is compared to an inverted bridge, it must not be forgotten how necessary it frequently becomes, to consider these braces in a different capacity, and to provide for this contingency, as indeed Mr. Seppings has not neglected to do, by employing such fastenings as are extremely well adapted to secure their action as ties.

The shelf pieces, which Mr. Seppings employs, and the superior strength of the fastenings of his decks to the breast hooks and transoms, have so obvious a tendency to counteract the causes of arching, that it is unnecessary to insist on their utility: the weight and expense of the shelf pieces are probably the only drawbacks upon the advantages, which they are so manifesly calculated

calculated to afford, in resisting both a vertical and a lateral strain: and even in these respects, they appear to be preferable to the wooden knees formerly employed.

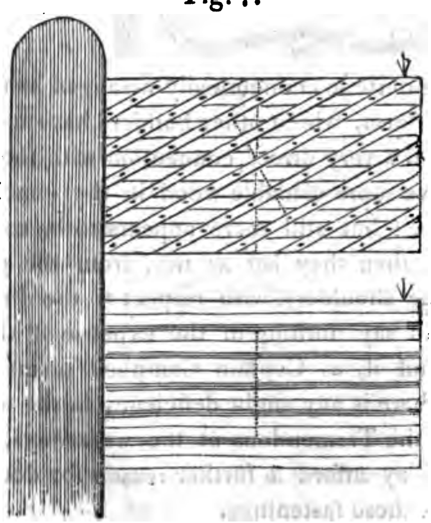
The filling up the intervals of the timbers, throughout the hold, with wedges of old stuff, is perhaps the most indisputably beneficial of all the alterations which Mr. Seppings has either introduced or revived in an improved form. The strength, which is thus obtained, acts immediately in the prevention of arching, and is probably, in this respect, more than equivalent to that of the internal planking, which has been omitted; while the cohesive strength of the external planking, considered as a tie, is still probably more than sufficient for resisting the smaller force, which occasionally operates in a contrary direction: although the strength of the ship, for resisting such a force, is certainly much diminished by the change. From the manner in which these wedges are driven by Mr. Seppings, it may easily be understood, that they may tend to produce a convexity below, without raising any part of the keel from the blocks, merely causing it to press more strongly on them at the midships; so that if this difference becomes equal to that of the weight and pressure after launching or floating, there may be no tendency to any further change whatever; and hence it may happen, that without any other superiority of stiffness, or even of workmanship, a ship may appear wholly exempt from arching, as the Tremendous did, and some other ships are said to have done. Without the operation of some such cause, even a hollow cylinder of compact oak, 180 feet long, fifty feet in diameter, and six inches in thickness, if such a mass could be supposed to exist, would exhibit, when immersed to the depth of its axis, a degree of arching just perceptible, from the longitudinal pressure of the water only, amounting to about one-

one-sixteenth of an inch; besides a curvature proportionally greater from the other strains, which have been already calculated. Mr. Seppings has also very properly introduced, in the Tremendous, an additional kelson on each side of the step of the mainmast, in order to support its weight, and to prevent the partial sagging of the keel.

10. *Riders.*

With respect to the transverse strain, or the tendency of the sides to sink in comparison with the keel, some strength is probably gained by Mr. Seppings's mode of fixing the filling timbers in the same manner as the frames; and some advantage must be attributed to the co-operation of the wedges, or fillings in, with the timbers, as far as their connection is capable of bringing them into action. The common ceiling is by no means advantageously placed for assisting in a resistance of this kind, since it can only act where the curvature would be increased by the bending of the sides, and even there can only be compressed in a transverse direction, Fig. 7. The riders

Fig. 7.



commonly

commonly placed upon it, on the contrary, are very favourably situated for assisting in this action; but Mr. Seppings's riders are so much more numerous, as to possess, notwithstanding their obliquity, a still greater force. The fastenings of the beams to the sides are also concerned in resisting a strain of this kind, as well as in counteracting the tendency to an extension aloft, which is the more immediate consequence of the unequal pressure of the water against the ship's sides. Mr. Seppings's fastenings, so far as they depend on the shelf pieces, have probably some advantage over the more common ones; but the iron knees which he employs (Fig. 8 and 9) do not

Fig. 8. Fig. 9.

appear to be quite so economically arranged as the straps of a simpler form, which other builders have used; they afford indeed a very direct connection with the timbers, and they save some valuable wood in the chocks which support them: but still there appears to be some waste of strength when they act as ties, from the great obliquity of the shoulders, with respect to the direction of the force; to say nothing of the expense of the workmanship: and if, as Captain Campbell seems to have suspected, there is any slight deficiency in the transverse strength of the Tremendous at the waterways, the circumstance may afford a further reason for doubting of the utility of these fastenings.

11. *Decks.*

11. *Decks.*

The least obvious advantage attributable to the obliquity introduced by Mr. Seppings appears to be in his mode of laying the planks of the decks; parts which seem to be principally required to co-operate with the sides of the ship as ties in a longitudinal direction: for the slight curvature which is given to them, can no more render them incapable of such an action, than the bending of a towing rope prevents its pulling along a boat, But in the first place, the lower decks can have little or no action of this kind, from their near approach to the line, at which extension ceases, and compression begins, at least until some of the fastenings give way; and, secondly, the upper decks lose but one-third of their strength in this capacity, by having their planks disposed at an angle of forty-five degrees with the sides, while the obliquity must be capable of affording some additional power of resisting the violent action of the waves, which sometimes produces an immense strain in a transverse or lateral direction, as well as of enabling the ship, in case of necessity, to be more safely "hove down" on her side. There seems also to be some convenience in having the ends of the planks covered by the water-ways, with respect to keeping the wings of the ship dry, although it has been suspected that the ends so covered may be rendered somewhat more liable to decay. It may, however, be apprehended, that any force, tending to shorten the deck, will have some little effect in forcing out the sides; for instance, if the whole deck became three inches shorter, the length of the planks remaining the same, they must force out each of the sides about a quarter of an inch, provided that their connection with the beams allowed such a change, which appears indeed somewhat improb-

 able.

able. There may possibly be a slight difficulty in adjusting the planks to the curvature of the beams; but this difficulty appears to be readily overcome in other cases, as in that of the common cieling. It may hereafter deserve to be inquired, how far an oblique direction of the carlings between the beams, which in their present situation seem to contribute very little to the strength, might enable them to co-operate in resisting a lateral force, if the arrangement could be made without too much weakening the beams, in procuring proper abutments for these pieces.

12. *Floors.*

It cannot easily be admitted, that Mr. Seppings's construction affords any additional strength to a ship's bottom in case of her grounding. The fillings in between the timbers must indeed be extremely useful in this respect, first, by giving firmness in the direction of the length, since even a straight plank is strengthened by having the incompressibility of its outside increased, much more one that is curved, in however slight a degree; and, secondly, by co-operating with the timbers, considered as shores, so far as the wedges are fixed in their places by their lateral adhesion, or otherwise.

The cieling, which has been omitted, can have very little effect by its own strength in preventing the separation of the timbers at the floor heads; but where there are transverse riders, it must be of essential advantage in enabling these to come into action, for the support of the neighbouring parts exposed to pressure; somewhat more effectually indeed, in many cases, than Mr. Seppings's diagonal riders and their trusses can do, notwithstanding the superiority of their number and aggregate strength; on account of the magnitude of the intervening

vening spaces, which might happen to receive the principal stroke near their centres. This magnitude does not, however, contribute by any means in the same proportion to the weakness of the parts, as it would do if the surface were plane: and it is not improbable, that, for supporting the weight of the ship on a very soft ground, Mr. Seppings's arrangement might afford equal strength with the common form, as seems to have been exemplified by his experiment of leaving the Tremendous for three days on fourteen shores only, without injury: but for encountering the stroke of a rock, or of very hard ground, Mr. Seppings's ship would probably be inferior, since in this case greater stiffness, even with equal strength, would be detrimental rather than beneficial; while, on the other hand, she would undeniably be less liable to suffer from any injury that might happen to her outer planking only; and, from her superiority in this respect, might possibly sustain, without inconvenience, a stroke, which would be ultimately fatal to a ship of a different construction.

13. *Durability.*

There does not seem to be the slightest ground for the apprehension, that the filling in should render the ship's timbers liable to decay: on the contrary, the timbers of the Sandwich were found perfectly sound in the lower half of their length, opposite to the wedges which had been driven in between them, and completely decayed in the upper half, where they had been exposed in the usual manner, to the action of the confined moist air and water; and this result is perfectly conformable to analogy with the few facts that have been ascertained, respecting the general causes of decay. The utility of the filling in, for preventing the accumulation of filth, and for keeping the

ship free from foul air, with respect to the comfort, and perhaps to the health of the crew, is too obvious to require discussion. How far the economy of timber may in all cases be so great as Mr. Seppings is disposed to believe, can best be ascertained by those who are in the habit of estimating its value: but if the durability of the vessel only were improved, at an equal expense, the adoption of his alterations would still be highly advisable.

14. *Conclusion.*

It is by no means impossible, that experience may suggest some better substantiated objections to these innovations, than have hitherto occurred: but none of those objections, which have yet been advanced, appear to be sufficiently valid to warrant a discontinuance of the cautious and experimental introduction of Mr. Seppings's arrangements, which has been commenced by orders of the Board of Admiralty. The filling in seems to be wholly unexceptionable: the braces between the ports appear to be decidedly more beneficial than the planks for which they are substituted; and the coakings seem to be very judiciously employed in various parts of the structure: but something more may possibly be hereafter effected for the further improvement of the decks, and for the more complete provision of a substitute for the thick stuff of the cieling, in addition to the diagonal riders, if experience should prove that there is any deficiency in the resistence of these parts. But it must be remembered, in forming conclusions from such experience, that when an arrangement of any kind has nearly attained the maximum of its perfection, it may demonstrably be varied in a considerable degree, without a proportional alteration of its effect; so that the most correct knowledge of scientific principles, and the minutest accuracy

in

in their application, must become indispensably necessary, in order to secure us from the introduction of material errors, derived from the latent operation of accidental causes, foreign to the immediate subjects of investigation.

*** Our limits having obliged us to omit many of the algebraical notes subjoined to this paper, as being chiefly interesting to the theoretical reader, we must refer those who desire to consult them, to the original work in the Royal Transactions.

Description of an improved Cart and Drag.

By Mr. James Braby, *of Vine-street, Pedlar's Acre, Lambeth, Surrey.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Five Guineas were voted to Mr. Braby *for this Communication.*

I BEG to leave herewith a model of my improved Sussex dung-cart, with props attached to it, to act as a drag, and prevent the shaft-horse from falling in going down steep declivities, as, by means of such props, the weight is entirely taken off the horse's back, and one or both wheels locked, so as to act as a sledge, and occasion the cart to descend a hill with an easy regular motion. The descent of hills is usually hard firm ground, and the fronts of the props being sloped upwards, they will readily slide over stones, or inequalities of the road. In every case, where a wheel requires to be locked, this prop may be used to a greater advantage, and it may be applied to one

or

or both wheels, as judged necessary, and will be a great relief to the shaft-horse. This cart is also well calculated for laying dung upon land, as it may be retained in any angle required, so as to permit the manure to be laid in separate heaps on the field, without tearing up the grass-sod of meadows, as is done when the common tail prop is used.

The drag has three holes at top, any one of which goes on a bolt in the shaft at B, and is secured by a pin; at the other end is a block, suited to the curve of the wheel, and faced with iron, the point of which turns up like the iron of a skait; this is fastened to the wheel by

Fig. 1.

a chain, and keeps its place by the hook rising on one side and the chain loop on the other, as shewn in section, Fig. 2. The advantage of this drag is, that the whole

Fig. 2.

weight

weight of the cart is taken from the horse, and rests on it; for the base which it adds to the wheel is about one-third its diameter. This is also the best prop, as it locks the cart, and let the horse move ever so much he cannot bring the weight on himself, and if left he cannot run away. The cart is also poised exactly on the shaft over the axis, and the weight can be thrown forwards or backwards, or placed even on the axis at pleasure, (whether going up or down hill,) by the adjusting bar M, in front of the cart, Fig. 1, which slides through the middle of a cross bar N: and by the two pins O O, the cart is kept at the height required for poising.

Fig. 3 shews how the axis of the adjusting bar is fixed to the shafts.

Fig. 3.

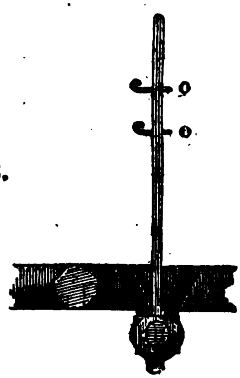
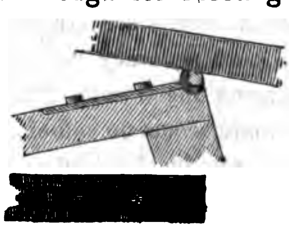


Fig. 4 is the hook which attaches the cart to the shafts: this hook so fits the hole, that it can never get off till the cart is down low enough for shooting the load; and

Fig. 4.



should

should it then be liable to jolt off, a chain may be added from the middle front of the cart to the middle of the axis which will be tight in that position, so that it can never get off without loosening the chain. The drag must be unpinned from the shaft, as well as unchained from the wheel to take it away, and may then be hung from the shaft to the axletree, or along the shaft to which it will chain, as to the wheel. Two drags may be used at once, as here shewn, if preferred.

Description of an Equation Work for a Clock.

By Mr. HENRY WARD, *of Blandford.*

With a Plate.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal and Five Guineas were voted to Mr. WARD *for this Communication.*

I HAVE often thought that, if some cheap and simple mode of shewing the sun's apparent diurnal motion by a clock could be contrived, it would not be the least useful and convenient improvement in the artificial measure of time. For as the sun's apparent motion is constantly varying from his mean motion, and the difference arising from this variation sometimes amounts to more than a quarter of an hour: and, farther, if the great perfection to which pendulum clocks are arrived at in the present day, and the extreme accuracy with which they are capable of representing mean solar and sidereal motions, are considered, there seems no sufficient reason why an error of such magnitude should be entirely neglected. Agreeably to this idea, I send, for the inspection of the Society

Mr. H. Ward's Equation Work for a Clock.

Fig. 3.

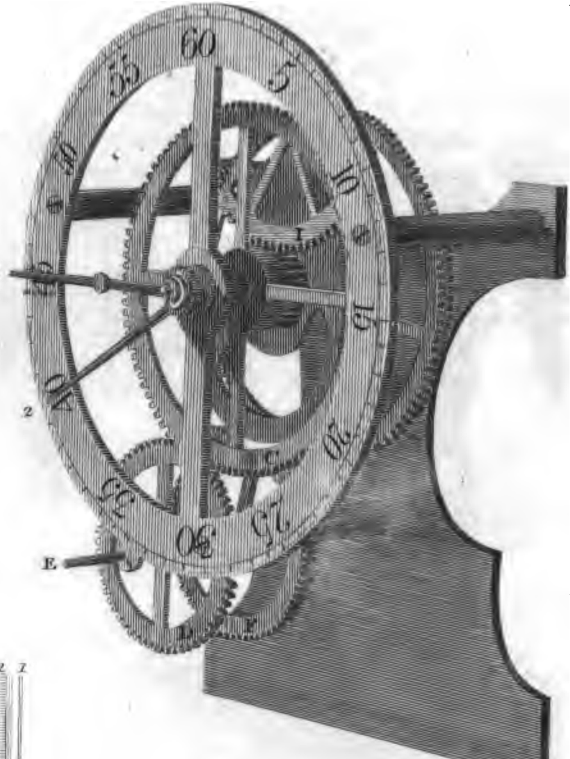


Fig. 1.

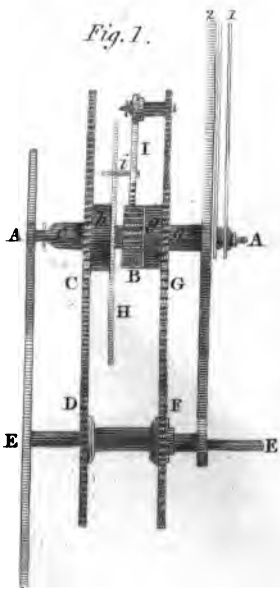
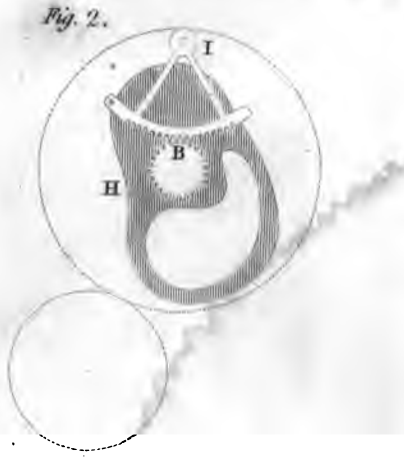


Fig. 2.



Society for the Encouragement of Arts, Manufactures, and Commerce, a model of an equation apparatus, which I invented and applied to a regulator that I made about six years ago, and which is found to perform extremely well.

The application of the equation of time, or rather the sun's apparent diurnal motion to a clock, is by no means a recent discovery. Several clocks of this kind were made nearly a century ago both in England and in France; but the complexity of their construction, the extreme difficulty of execution, the incapacity of the greater number of workmen, to which may be added the expense, have operated as insurmountable obstacles to the introducing them into general use: so that, for many years past, clocks of this description have been but little in request, and the making of them laid aside, and almost forgotten.

The first clock of this kind that we have any account of was found in the cabinet of Charles the Second, King of Spain, about the year 1700, as may be seen in Sully's "Regle Artificielle du Temps," edit. 1717. But the author of this curious invention did not then appear to be known. Mr. Williamson, an English artist, however, in the "Philosophical Transactions," No. 363, asserts his right to it, and says he is well satisfied that this clock is one which he made for Mr. Quare, who sold it soon after, to go to the said Charles the Second, King of Spain. Mr. Williamson has not given us a description of the mechanism, but merely states that there were two fixed and two moveable circles; the former shewing the hour and minute of mean time, the latter, which were concentric to the former, that of apparent time. In the same paper he also tells us, that shortly afterwards he made other clocks for shewing apparent time, by raising

 and

and depressing the pendilum through a slit in a piece of brass, so that its vibrations would agree with the sun's apparent motion throughout the year.

Equation clocks were first made in France, about the year 1717, by M. le Bon and M. le Roy; though a project of this kind, by the Reverend Father Alexandre, was laid before the Academy of Sciences as early as 1698. The clocks constructed by M. le Bon scarcely differ from that in the King of Spain's cabinet; they had two concentric circles, one of which was moveable, and its motion was regulated by an equation plate, that performed a revolution in a year. Clocks, and watches too, with moveable circles, have since been made with some improvements by several French artists; and, as far as simplicity is concerned, are perhaps the best of any that have hitherto been constructed.

A much more elegant mode of shewing *mean and apparent* time is by two minute hands; one of which moves concentrically to the other, and has a piece of brass attached to it representing the sun, to distinguish it from that which points out mean time. Some excellent clocks of this sort have been made by Graham; they have likewise been made in France by Le Paute, Passement, Berthoud, &c.; but all of them are so extremely complex, that it is no wonder they have not been more generally in use. These clocks require not only an annual motion, in common with all others of the kind, but there is an addition of several wheels to the minute work, that renders them extremely difficult of execution, and, without great care, liable to considerable sources of error.

The model herewith sent has two minute hands; it has no real annual movement, but only a relative one. By these means the construction is rendered simple, and the execution easy. It may be made in less than a week by

any

any ordinary workman, who comprehends the use of its parts.

I cannot conclude this letter without expressing my regret that we have no complete Treatise on Clock and Watch work in the English language. It is more to be lamented, because this country stands pre-eminent in the mechanical arts; and the greater number of useful inventions and improvements have been made by English artists. Some excellent works on this subject have been published in France, Germany, and even in Spain. For the honour of our country, as well as for the benefit of the public, let us hope that some geometrician and mechanist will one day favour us with a work on a subject of so much importance — a work certainly much wanted at the present time.

Description of the Equation Work.

It will be proper first to explain the principle upon which the annual motion is founded; when that is done the rest will be easily understood. It consists of the difference of velocities of two wheels, that turn concentrically to each other; to effect which the following numbers are employed:

111.79.
137.64.

If 111 be multiplied by 79 the product will be 8769; and 137 multiplied by 64 gives 8768, the difference being unity. Now if the wheel of 111 teeth be made to revolve in an hour, the end is obtained; for it makes one revolution less in a year than the wheel of 137 teeth. It may be observed, however, that 8768 hours exceed a tropical year by a little more than two hours; but this differ-

ence is so extremely small, that in practice it may be altogether neglected, for the error will not become sensible till after several years.

Reference to the Plate.

The mechanism will be best explained by a profile, A, A, Fig. 1, (Plate XI.) represent a steel arbor, to which is fixed a nut B, of 24 teeth; this arbor also carries the apparent time hand 1. C is the minute wheel of 111 teeth, screwed to a brass socket *b c*, which turns on the arbor A A; the end of this socket is the fore pivot to the arbor, is armed with steel, on the extremity of which is the mean time hand 2. The minute wheel drives a wheel D of 64 teeth, keyed on the arbor E E: the fore pivot of this arbor is squared, by which it may be turned at pleasure, so that the equation may be set right, by means of a table, if at any time the clock should have stopped. On the same arbor is fixed another wheel F, of the same diameter, containing 79 teeth, that drives a wheel G of 137 teeth, screwed to the socket *g g*; this socket turns freely on the arbor A A, and to it is also screwed the equation plate H. In the periphery of the wheel C there is a stud, carrying a toothed quadrant I I, which works in the nut B; a pin *i* is fastened in one extremity of the quadrant, which, by the revolving of the equation plate, is moved backwards and forwards; but, in order to keep the pin in contact with the plate, a piece of very narrow watch-spring is inserted in the boss of the minute wheel, hollowed out for that purpose: this spring, which ought to be weak, is hooked to the arbor of the nut B.

Fig. 2 represents a front view of the quadrant, nut, and equation plate 2, by which the operation may be readily understood.

This

This apparatus cannot conveniently be placed on the centre pinion so as to derive its motion from it, but motion may be communicated from the movement to the minute wheel in any way the ingenious artist may judge best calculated to suit the particular construction of his clock.

Of dividing the Equation Plate.

As the dividing the equation plate may appear difficult to many, I have judged it necessary to offer some directions to facilitate the business. For this purpose I have constructed an Equation Table for a year, divided into 137 parts, each part consisting of an interval of 64 hours, and consequently corresponding to one tooth of the wheel, which carries the equation plate. By this means the operation of dividing the plate is rendered as easy as that of a common snail. The method is as follows;—Having fixed in the extremity of the quadrant a temporary screw with a sharp point, I put the minute wheel with the quadrant, and the wheel of 137 teeth with the equation plate, upon the arbor A A, and placed them in the frame. A piece of iron wire flattened, with one end bent to a right angle, was held fast to the frame by a hand-vice, with the bent end resting in the teeth of the wheel, so as to retain it in any position. The minute wheel was made fast to the frame by a clamp, the mean time hand pointing exactly to 60 on the minute circle; the apparent time hand was then brought to 60 also, and the screw in the quadrant, whose point was nearly in contact with the plate, was gently struck with a hammer, so as to make a small impression; I then shifted the plate forwards by one tooth of the wheel, and moved the apparent time hand forwards, as near as the eye could judge, 39 seconds, *(see the annexed table,)* and made a second impression; then moved

moved the wheel another tooth, and set the hand to one minute fourteen seconds; and thus I proceeded until I had got a series of dots all round the plate, to which it was afterwards filed away.

A Table useful in dividing the Equation Plate.

M S	M S	M S	M S	M S	M S
0.. 0	0..37	2..51	15..40	1..29	12..41
+0..39	1..11	2..12	15..57	2..47	12.. 7
1..14	1..46	1..29	16.. 8	4.. 9	11..30
1..46	2..20	−0..42	16..15	5..18	10..50
2..16	2..54	+0.. 6	16..16	6..28	10.. 7
2..41	3..25	0..56	16..10	7..36	9..23
3.. 4	3..55	1..49	15..58	8..40	8..37
3..22	4..22	2..43	15..41	9..40	7..49
3..37	4..47	3..38	15..17	10..35	7.. 1
3..48	5.. 8	4..33	14..47	11..25	6..11
3..55	5..27	5..29	14..12	12.. 9	5..22
3..58	5..42	6..25	13..29	12..47	4..32
3..56	5..54	7..21	12..43	13..20	3..43
3..50	6.. 2	8..16	11..50	13..47	2..55
3..41	6.. 6	9..10	10..54	14.. 7	2.. 8
3..27	6.. 5	10.. 1	9..52	14..23	1..23
3..10	6.. 0	10..52	8..42	14..32	0..40
2..49	5..51	11..40	7..36	14..36	0.. 0
2..26	5..37	12..26	6..24	14..35	
2.. 0	5..19	13.. 8	5.. 8	14..28	
1..32	4..57	13..47	3..50	14..16	
1.. 2	4..31	14..22	2..30	13..59	
+0..30	4.. 1	14..52	+1..10	13..37	
−0.. 4	3..28	15..19	−0..10	13..10	

An

An Account of some delicate Plants cultivated in the Open Air in the Island of Guernsey; with Hints on the Means of naturalizing tender Exotics.

By Dr. MACCULLOCH, *of Woolwich.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

HAVING visited the Island of Guernsey some years ago, I was much struck with the peculiar luxuriance exhibited by many plants, which either grow with reluctance or refuse to grow at all, even in the mildest counties of England. The variety and splendour of these productions give a character to its horticulture, which is very impressive to an English visitor, and which excites surprise, when compared with the very slight advantages of climate this island appears, from its geographical difference of position, to possess. As some of these facts seem capable of leading to useful results in this valuable art, I have turned to the notes I then made, with the hope that they might afford you a few minutes amusement. Among those productions, its Amaryllis * is almost too well known to be enumerated. It is said to have been brought from Japan, a country possessing such a variety of climate, that it might well afford plants suited to any latitude. I think, however, it is yet a point to be ascertained, whether there is any thing in the climate of Guernsey peculiarly favourable to the growth and flowering of this plant. This is a fact which cannot be determined till the cultivation of it is carried on in England to the same extent in which it is practised in Guernsey. The gardeners of Britain are satisfied with returning to the earth the few roots they receive in flower, but are scarcely

* Amaryllis Sarniensis.

content

content to wait till the period of flowering of the exhausted individual shall again return. From such impatient and narrow trials no conclusion can be drawn against its possibility. In Guernsey, every gardener, and almost every petty farmer, who has a bit of garden ground, appropriates a patch to this favoured root; and the few hundreds of flowers which are brought to England in their season, or which are kept for ornament on the island, are the produce of thousands of roots which are there planted. The average rate of flowering is not more than fifteen or eighteen in a hundred. The soil in which they are raised is light, and the beds are covered with sand; in other respects there is no particular care taken of them, except keeping them very clean. What portion of this success depends on climate cannot, as I have already said, be known till experiments on a similar scale are tried in England. It is however true, *that the* bulbs are frequently injured in the winter, by a frost which has no effect on the hardy geraniums; so that it would be requisite in this country to guard againt this danger, at least by matting or occasionally covering the beds. I may add, that some of its congeners, the Amaryllis, belladonna, vittata, undulata, and formosissima, also flower in Guernsey without care, and with great certainty and vigour.

A shrub of great beauty, the Magnolia grandiflora, is well known to be shy of flowering in England, if we except the mild climate of Cornwall, to which that of Guernsey bears a near resemblance. In this little island, however, its flowering is as certain as its growth is luxuriant. Among the more hardy of the tender plants which also grow freely in Guernsey, and which Cornwall but barely preserves through the rigour of winter, are the Hydrangea hortensis, Fuchsia coccinea, Geranium zonale,

nale, inquinans, radula, glutinosum, and some others, which pass the winter without difficulty, and emulate in the summer the luxuriance they possess in their native climates. Many tender and transient varieties of flowers, and among those the varieties of the pink tribe, are remarkable for the facility and certainty with which they are propagated, and for the constancy of their characters. Every rustic cottage is covered with geraniums, and ornamented with numerous pinks, rarely seen in this country but among careful florists. Even the green-house is influenced by the climate. It is well known, that the Heliotropium Peruvianum, a plant otherwise of sufficiently easy cultivation, is in England much limited in its growth, becoming woody and feeble after it has attained a certain height. Here, on the contrary, if placed on the bed of earth in the house, although no artificial heat be applied, it soon fills the whole space, running over the bed, and striking fresh roots from its branches as it advances. But of all those shrubs which require the protection of the green-house in England, the Verbena triphylla is that of which the luxuriance is here the most remarkable. Its miserable stature and bare woody stem are familiar to us. In Guernsey it flourishes perfectly exposed, and attains the size of a tree of twenty feet and upwards, spreading in a circle of a diameter equal to its height, and its long branches reaching down to the ground on all sides. Its growth is indeed so luxuriant, that it is necessary to keep it from becoming troublesome, by perpetually cutting it almost to the root; from which fresh shoots, fourteen feet in length, resembling those of the osier willow, are annually produced. I may also enumerate a few other plants, of tender constitution in Britain, which appear equally hardy in this more uniform climate. The Celtis micrantha, which ranks among our stove-

 plants,

plants, grows with very little care out of doors. So do both the double and single varieties of Camellia Japonica, the latter often attaining the height of twenty feet. Some species of Olea are also hardy, as well as many of the Proteas, the whole of which require in our own island the shelter of the green-house. Such is the case also with many species of the genus Cistus, and among them I may name crispifolius and formosus. I may add to this enumeration, Yucca aloifolia, Dracocephalum, Carnariense, Jasminum Azoricum, Nerium oleander, Clethra arborea, Daphne odorata, Mimulus glutinosus, Correa alba, Melaleuca hypericifolia, Gorteria rigens, together with a very large number of the genera Ixia and Erica, all equally requiring the protection of the green-house, during the severer winter of our island, and many of them subject to perish at that season, notwithstanding this care. I need scarcely add, that the Myrtle *defies the utmost* rigour of a Guernsey winter, and flourishes in the greatest luxuriance.

In the production of many fruits, the gardens of this island are no less remarkable. The superiority of its Chaumontelle pear is well known, a superiority which the grafts imported into England do not retain. Yet in this respect it yields to its neighbour, Jersey; and I may add, for the consolation of English gardeners, that this pear, even in these islands, is reared under the warmest walls, succeeding but indifferently in any other situation. The purple and green fig grow readily as standard trees, and produce perfect fruit every year. Many varieties of the melon ripen without glasses. The Romana is even raised in Jersey, without the assistance of the hand-glass, and is cultivated there in large quantities. The usual method of proceeding with it is to dig a hole in the earth, into which is thrown a small quantity of hot dung, and above

that

that ten or twelve inches of earth. The seeds are then sown, and the young plants, although sometimes covered with hand-glasses for a time, are often left entirely to Nature.

The attempts to raise Oranges have not been numerous; but in different gardens there are trees of the Seville and sweet orange, both standing under the shelter of a wall, and producing fruit in abundance every year. They require, however, to be protected by mats in the winter. In a lower, but not less useful department of this art, the Parsnip, the favoured root of the island, is remarkable for its bulk and goodness.

But the circumstance to which I would chiefly call your attention, is the naturalization of a native of very warm climates, the Canna Indica; a circumstance which confirms and illustrates the remarks made by Sir Joseph Banks, on the naturalization of Zizania aquatica. This very tender plant has become thoroughly habituated to the climate, scattering its seeds every year, so as to prove a weed in the gardens which it has occupied. I attempted to introduce it here also, from seeds which I brought from Guernsey; but my experiment was interrupted by an accident, and I have never since attempted to repeat it. I think it is not only desirable that it should be repeated, but that similar attempts should be made to naturalize other ornamental or useful plants, which have as yet foiled us, chiefly perhaps because the trials have been ill conducted. Abundant experience has shown, that the propagation of a plant, by cuttings or offsets, has little or no effect in changing its constitution, and the instances above cited, equally shew us, that the seed will produce a hardier progeny, a progeny which in time may possibly be habituated to bear all the range of temperature which the globe affords. To carry this specu-

 lation

lation into practice, it is evident, that in most cases the attempt will be unavailing if the transition is violent; and that we should often fail in our endeavours to naturalize the inhabitants of Bengal or Jamaica, to the climate of England or that of Newfoundland. It is probable, however, that in the immense number of untried plants, many might be found which, like the Canna Indica, would even bear a change as great as that now mentioned: but to pursue this system of naturalization with any great hopes of success, it would be necessary that the transition should be more gradual, and that the transplantation should be carried from a hot climate, through some intermediate one, to our own more ungenial shores. The very peculiarity of the climate of Guernsey, arising chiefly from the uniformity of its temperature, would afford us ground to hope, that it possesses *many* of the requisite properties, and that it would form the step required in this experiment. It is certain, that neither the thermometric state of a given country, nor any meteorological condition which we have yet been able to observe, are competent to explain the peculiar affection of plants for particular regions of the earth. The observations of Monsieur Ramond, in the "Annales du Museum," which have been translated by Mr. Salisbury, shew this in a striking point of vtew. From these we see the persevering regularity with which certain plants affect peculiar elevations, apparently unconnected with the nature of the soil, but bearing a relation alone to particular states of the atmosphere, which we have no means of appreciating. Similar facts are familiar to botanists in our own country, in the very limited zones of elevation, affected by our alpine plants. But perhaps of individual instances, the strongest and best known is that of the Caper, Capparis spinosa, whose delicacy of sensation

tion has, I believe, hitherto precluded its cultivation in any other climate than its native one. Whatever this obscure condition of a climate may be, it appears that the island of which I have been speaking possesses requisites appertaining to it which are not common, and which, to us at least, in the present state of things, are elsewhere inaccessible. These considerations, therefore, should stimulate us to make trials, which, in their results, may possibly prove useful as well as ornamental. Many of the fruits which are now too tender to bear our climate, might be taught to produce seeds, which would give us products equal in goodness to the original, and of hardier character. It is not unlikely, for example, that a variety of the Melon, from seeds produced in Guernsey, might be made to grow without the aid of glass in England. Perhaps even the Caper or the Orange might be naturalized through the same medium. That process which has naturalized the Canna Indica might go far to put us in possession of many other desirable objects, at least in cases where, like the melon, the generations can be rapidly repeated, and where the produce goes hand in hand with each successive generation. Thus, possibly, even the elegant pine of Norfolk Island, might become a British tree, although the toil of many years would be requisite for effecting such a purpose.

An economical object, which depends on this property of plants, remains yet to be noticed. This, which is still more in our power, is probably of more consequence than either of those above mentioned; I mean the perfect naturalization of the Vine. It is well known, that from many of the ordinary varieties cultivated in this country we can always insure a crop of grapes, but not always a crop of ripe ones. From two or three of these, the chance of ripening out of doors is considerable; from

many

many others it is hopeless. It is not improbable, that by successive sowing of seeds other varieties might be produced, still more certain of ripening than those which succeed best with us, the Miller and Sweetwater. We should thus acquire possession of an article of cultivation of great importance, by which a useful addition would be made to the agricultural proceeds of land in particular situations, and by which we should be enabled to fabricate wines of quality sufficiently good to compete with those of foreign growth.

A more important object is the perfect naturalization of the Potatoe, an effect as yet but very partially obtained, notwithstanding the length of time during which this valuable root has been a subject of cultivation. It is certain, that this imperfect naturalization has been the result of the common practice of propagating by the tubers, to the almost total neglect of the *seeds*. *It is* true, that seeds have been occasionally sown, and new varieties thus produced; but the experiment has stopped in the first stage, having been always undertaken for the mere purpose of producing these varieties, without any regard to that much more important object, the production of a plant sufficiently hardy to bear at least the first frosts of winter. In the southern parts of our island, it is not a desideratum of much importance, as the tubers are in general fully formed before the plant is killed by frost; but in the northern parts it is an object of great consequence, the plant being frequently killed long before the roots have attained maturity. In the Highlands of Scotland, in particular, where a frost will frequently occur early in September, the crop is often prematurely destroyed, and the uses of this vegetable are in consequence materially limited. It is plain, that it would be necessary to sow the seeds of successive generations

many

many times, before the requisite degree of hardiness could be expected, and that the process would demand both patience and time. Yet, if it requires more of these than we can expect from the ordinary cultivator, it is an experiment which we may at least recommend to those public bodies, who so laudably exert themselves in ameliorating the agriculture and horticulture of this country. The difficulty of procuring seeds from seedling plants could doubtless be obviated in some measure by depriving the young plant of its tubers, and thus compelling it to direct its energies to the other and more common mode of propagation, with which Nature has provided all plants.

I cannot, however, conclude this speculation without noticing a formidable objection, which stands in the way of our attempts to naturalize particular plants. In every case where the useful varieties have been the result of cultivation in a warmer climate from a base and useless parent, it is to be feared that the process followed in naturalization, would again throw the plant back to its original state. This objection applies chiefly to those fruits, such as the peach, the apple, and grape, which, in their present cultivated state, are almost entirely the produce of art. For this reason it is not improbable, that all attempts to naturalize the grape to a cold climate may fail; yet the trial deserves to be made. The case does not apply equally to the potatoe. The original plant appears to be valuable, independent of any artificial character, and would consequently admit of a change, tending even to some degree of deterioration before it was materially injured in its properties.

On

On the Causes of Canker in Fruit Trees.

By Mr. James Smith, *Glasgow.*

From the Transactions of the Caledonian Horticultural Society.

IT is generally allowed among gardeners, that the canker in fruit trees proceeds from the roots having got into a bad soil. However general this opinion may be, I would beg leave to differ from many of my brethren on that subject. For some years past I have had an opportunity of observing a good many trees in a cankered state; and, in my present situation, I have a good many trees infected. Having imbibed the above general opinion, I accordingly, in January 1810, uncovered the roots of several of my worst infected trees, in order to cut any of them that might have got down into the bad soil. The first I uncovered I found, that about two feet and a half below the surface, previous to the trees being planted, there had been a bottom laid, nine feet in diameter, with brick and lime. I followed each root out to the extremity, and found that none of them had ever touched the subsoil. I tried several more of them, and found they had all bottoms of the above description.

I have likewise a good many trees on the wall, all in a healthy state, none of them having the least appearance of canker. In February 1811 I trenched the border along the wall in which the trees are planted; I examined the roots of every one of them, (thirty-four in number,) and found that the roots of most of them had got down into the bad soil, as no bottom had been made for them when planted. The soil in many places was not above thirteen inches deep, and many of the roots had run down about thirty-five inches into the bad soil.

When

When I found that the trees on the wall were not cankered, although the roots were in such a bad condition, I began to think that the canker must proceed from something else than bad soil. I examined my standard trees more minutely, and found that all the early kinds were considerably worse cankered than the late ones. I then thought, and am now almost convinced, that the canker proceeds from the frost injuring the sap. In order to ascertain how far this might be true, I determined on trying an experiment. On the night of the 3d of May 1811 we had a pretty sharp frost; and several of my trees had made good shoots by that time: I, next day, tied a piece of small thread round a good many of my young shoots, as a mark, in order to ascertain, in the end of the season, whether the frost had done them any injury. I likewise marked a good many buds which had not yet begun to push, but which I thought were likely to do so. On examining my trees during the winter, I found that none of the shoots made from the buds which had not begun to push, were in the least inclined to canker, whilst the greatest part, though not the whole, of the others are cankered. I intend this spring to try some more experiments, which I hope will be more satisfactory. The above is only intended as a few hints, in order that any member of the Society may make the like or other experiments, to ascertain how far the above is entitled to credit.

Note on the Pyro-ligneous Acid, or Acetic Acid, produced during the Carbonisation of Wood in close Vessels.

By M. Deyeux.

From the Annales de Chimie.

THE utility of chemistry would be confined within very narrow limits, if those who devote themselves to the study of that science were content with presenting merely insulated facts; but when, after collecting they endeavour to arrange them, when by dint of research they succeed in proving that a proper application of the result of their labours may lead to the creation, as it were, of new products, or to the multiplication and improvement of those which are in common use and of indispensible necessity, it is then impossible to deny that chemistry must be classed among the sciences most worthy of being cultivated.

But if the evidences of the utility of chemistry are now so numerous that there is no need to adduce new ones, I am nevertheless of opinion that we ought not to omit opportunities of collecting such as from their importance are peculiarly deserving of attention. With this view I shall present the reader with some observations on the kind of acid produced by wood during its combustion, and on the use which may be made of this acid either in pharmacy, in the arts, or for domestic purposes.

It has been long known, that among the products furnished by vegetables when decomposed by means of heat, in vessels for distillation, there is always found a considerable quantity of acid. But it is a circumstance worthy of remark, that its smell and taste alone attracted any attention, and that, without taking the trouble to make researches in order to ascertain its nature, chemists contented

contented themselves with considering it as an acid *sui generis*, to which, on account of the process employed to obtain it, they gave the name of *Pyro-ligneous acid:* they even endeavoured to assign it a place among the vegetable acids; and, in short, did all they could to insinuate that it bore no resemblance to any of the known acids.

Things remained in this state till it was found necessary to subject the pyro-ligneous acid to fresh experiments, with a view to determine with greater certainty whether the properties ascribed to this substance belonged exclusively to it. Fourcroy and Vauquelin, who undertook this task, soon discovered the mistake under which they, in common with other chemists, had been, in considering the acid in question as a particular acid, whereas in fact it did not differ from acetic acid, especially when it was separated from the extraneous matters with which it was intermixed.

The proofs with which these two chemists supported their opinion on this subject seemed so conclusive, that it was impossible to call them in question: accordingly the appellation of pyro-ligneous acid was soon superceded by that of acetic acid, which in every respect was infinitely more appropriate.

As to its formation, the same chemists ascribed it to the oxygen, hydrogen, and carbon, which, separating from one another during the combustion of the wood, afterwards re-united in proportions corresponding with those that are requisite for producing acetic acid.

So far the whole merit of this discovery was confined to the having ascertained a chemical fact, which, in regard to the science, could not be looked upon with indifference; but it was soon rendered more interesting. The carbonisation of wood in close vessels of great capacity having become the object of important specula-

tions, afforded occasion for obtaining the pyro-ligneous acid in large quantity. Instead of endeavouring to get rid of it as useless, the persons engaged in these speculations did not hesitate to consider it as a product from which advantage might be derived, and which might become an indispensable accessary to the profits expected from the sale of the charcoal.

One difficulty remained, and this was to disengage it from the oily empyreumatic matter, which gave it a very disagreeable smell and taste, and thus to bring it to the state of pure acetic acid.

Several attempts were made no doubt with this view, but all of them were not completely successful; yet at length, by dint of perseverance, means were found to procure a very good acetic acid.

Among those who most earnesly engaged in this operation, I must particularly mention Messrs. *Mollerat* as being the first who, to my knowledge, produced vinegar resulting from the rectification of pyro-ligneous acid in a state of very high perfection, and as the first who pointed out the useful purposes to which it might be applied, as well as the different preparations for which it may be advantageously substituted for common vinegar.

When once certain of the success of the means which they had employed to accomplish their object, Messrs. Mollerat thought it right to submit to the judgment of the first class of the Institute several specimens of the vinegar which they had prepared; and the Institute appointed Messrs. Fourcroy, Berthollet, and Vauquelin, to examine them, as well as the memoirs by which they were accompanied.

In the report made by those commissioners, they literally assert, that these specimens of vinegar are perfectly colourless and transparent, that they exhibit no traces of

extraneous

extraneous acids, nor of any salifiable base, neither do they, like common vinegar, contain tartar, malic acid, resinous and extractive matter; that they are not indeed so full and strong; but that they possess the advantage of resembling radical vinegar.

Conclusions so favourable ought naturally to have established the character of the acetic acid furnished by wood; that is to say, as its identity with common distilled vinegar was thus demonstrated, it seemed that not the least doubt ought to have been left respecting the advantages likely to result from its use in all such cases in which previously it was necessary to employ common distilled vinegar; but either from prejudice, or perhaps from motives of private interest, attempts were made to raise doubts of the good qualities, and particularly of the purity of this acid; it was even asserted, that for domestic uses it was attended with inconveniencies.

It would have been easy for Messrs. Mollerat to have answered the objections started on this subject, but they seem to have preferred leaving to others the task of dispelling prejudices, the more unreasonable as they were not founded upon any positive facts; even though they should run the risk of being deprived, as too frequently happens to the authors of new inventions, of the advantages they ought naturally to have derived from that to which their claim could not be disputed.

What Messrs. Mollerat foresaw has come to pass. M. Henry Lemercier, who is at the head of an establishment at Paris for the manufacture of chemical products, announces vinegar made of pyro-ligneous acid, and to which he has found means to impart the same, nay I may say superior, qualities to those of the common distilled vinegar. He declares that the process which he employs is simple and not expensive; and, as he asserts, that, by

means

means of an apparatus constructed for the purpose, he is able to distil six hundred pounds *per* day, it will be easy for him to dispose advantageously of a large quantity of that acid.

I have had occasion to examine this vinegar, and have found that it actually possesses all the qualities attributed to it by M. Lemercier. I have even remarked, that when it is combined with different salifiable bases, the salts obtained are so pure as to have no need of being purified. I shall mention among others the acetate of potash. This salt, which it is extremely difficult for druggists to procure very white and pure by a first operation, when they employ common distilled vinegar; this salt, I say, when prepared with M. Lemercier's vinegar, is obtained pure at once, and has all the properties of the best ordinary acetate of potash.

One of the great advantages which in many cases will doubtless lead to the employment of the purified vinegar of wood for the preparation of salts, is the facility that will be afforded of having it, at a low price, in a more highly concentrated state than that in which the best common distilled vinegar generally is.

It is obvious, in fact, that as a certain weight of the first-mentioned vinegar contains much more acid than a like weight of wine vinegar, a smaller quantity will suffice to saturate the salifiable bases, and that by these means the operator will save the expense of evaporating saline liquors, when he has occasion to concentrate them, in order to obtain crystallised salts, or merely to have them in a dry state.

I must not forget to observe, that the vinegar of wood combines perfectly well with the aroma of plants, and that it readily seizes the same soluble particles as are dissolved by wine vinegar, when macerated, digested, or infused,

fused, with vegetable substances. Hence it is evident, that it must be extremely serviceable for pharmaceutic purposes, and that the perfumers will be able to turn it to good account.

There is also another operation in which the use of the vinegar of wood will be very serviceable, I mean the extraction of soda.

It appears, indeed, that in some manufactories this acid is already employed to decompose the sulphate of soda; and that by means of it a carbonate of soda, more pure than that procured by extraction from muriate of soda, is obtained.

The process employed is extremely simple. It consists in boiling, for a given time, a solution of sulphate of soda with a solution of acetate of lime. In this operation the sulphuric acid leaves the soda to attach itself to the lime, and at the same time the acetic acid combines with the soda, and forms an acetate of soda: the latter salt being very soluble remains in solution, whilst the sulphate of lime, which is difficult of solution, is precipitated. When the operation is considered as finished, the liquor is left to cool, filtered, evaporated to dryness, and the residuum calcined in a furnace made for the purpose; and when the acetate is entirely decomposed nothing remains but a white substance, the solution of which in water needs only to be evaporated to a suitable point to furnish very fine crystals of carbonate of soda.

When the idea of decomposing the sulphate of soda with the vinegar of wood was first conceived, it was thought that this acid might be used unrectified; but it was soon found that the soda obtained from it was not pure, and that, to procure it in the state desired, it was necessary to have recourse to fresh operations, which of course rendered the process more complex. As there

is

is not this inconvenience with rectified acid, it is evident that it could not be long before a preference was given to the latter.

Whilst I insist on the advantages of the process of which I have been treating, I am far from believing that it ought to be considered as sufficient to induce the giving up of that which has for its object the extraction of the soda that forms the base of muriate of soda. The facility of having this salt in great quantity, and always at a lower price than the sulphate of soda, will undoubtedly occasion the first of these salts to be used in operations upon a large scale; but even though sulphate of soda should not be employed except in second-rate manufactories, still these would be certain to turn it to good account, especially if, as there is reason to hope, the means of procuring the sulphate of soda and the acid of wood should hereafter be multiplied.

I could have adduced several other proofs, demonstrating the many advantages that may be derived from the identity which has been ascertained to exist between rectified pyro ligneous acid and vinegar, if those which I have mentioned had not seemed sufficient to make those persons sensible of their error who would still raise doubts upon this subject. I am also persuaded that when convinced how much it is to their interest to prefer on many occasions this new acid to wine vinegar, they will not hesitate to employ it whenever the products which they seek to obtain need the concurrence of acetic acid.

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